Proposed New Building for the Massachusetts Institute of Technology, Newbury Street Elevation

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THE NEW BUILDINGS

Engineering Building "C," as it will be known, is the latest adjunct to the Institute. The excuse for its existence on the site of the Walker Memorial Gymnasium, as given to the alumni and friends of the Institute by President Pritchett in his address at the last Alumni Reception, is known to all the readers of the REVIEW. So also is it known that this building, as well as the Lowell Building which was erected last year, are to be considered only as temporary buildings, and not as permanent structures.

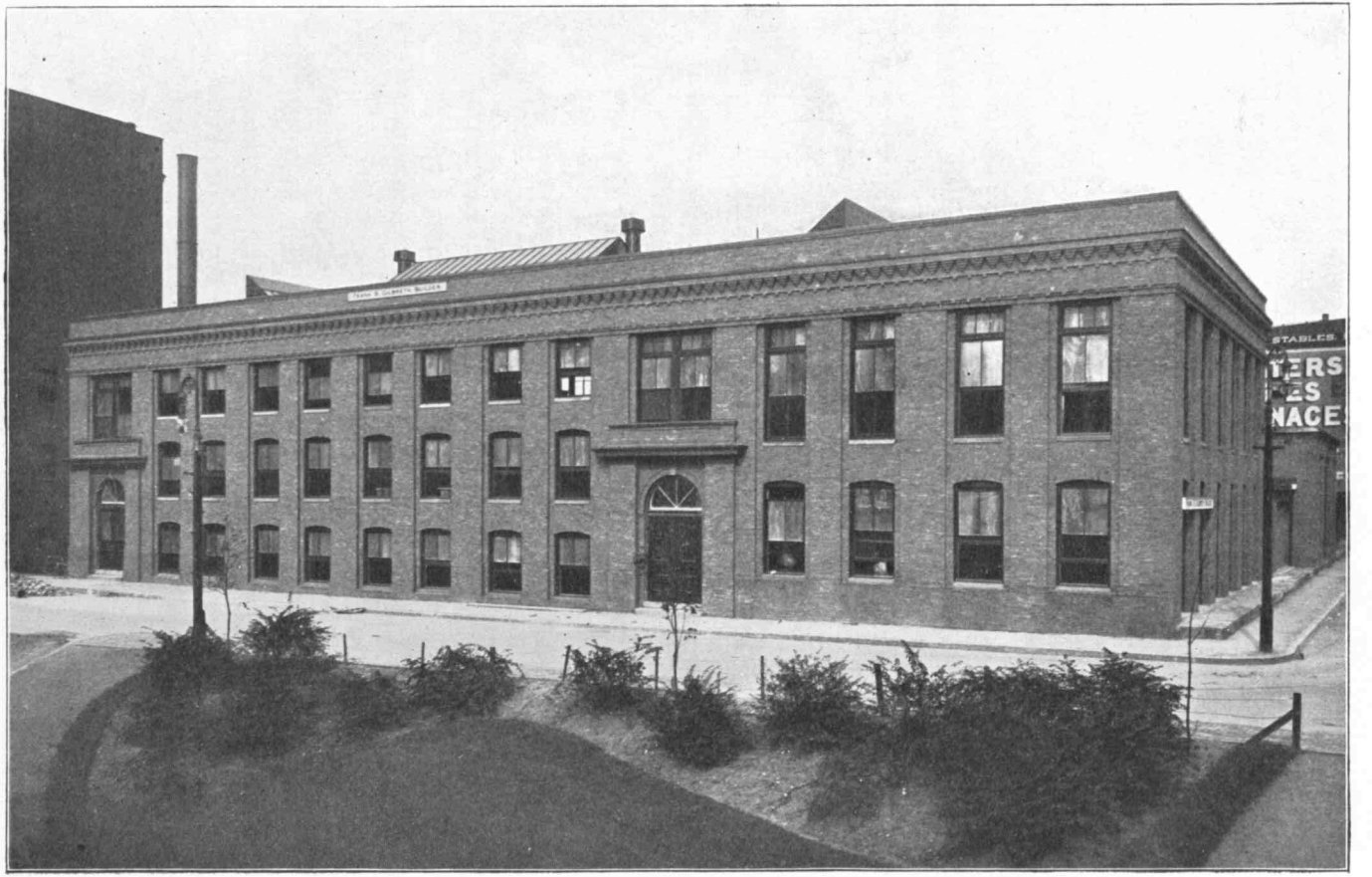
With the above in mind, Engineering Building "C" was planned to give the necessary floor space, on as small a ground area and for as small an expenditure of money as possible, to house the three Departments most in need of enlarged quarters. Those which could be moved with the least expense and which, by moving, would give the greatest relief in the other overcrowded buildings, were Naval Architecture, Mineralogy, and Chemical Engineering. It will be evident to those who see the building that no money has been expended on superfluous ornament, and that every detail of the structure is of the simplest and cheapest form and material which would answer the desired purpose and comply with the "Building Regulations of the City of Boston."

Engineering "C," as originally planned, consisted of two-story end pavilions containing the entrances, and a central three-story section; but, as constructed, the pavilion on the end nearest to the Pierce Building was omitted for the present, leaving an unbalanced design.

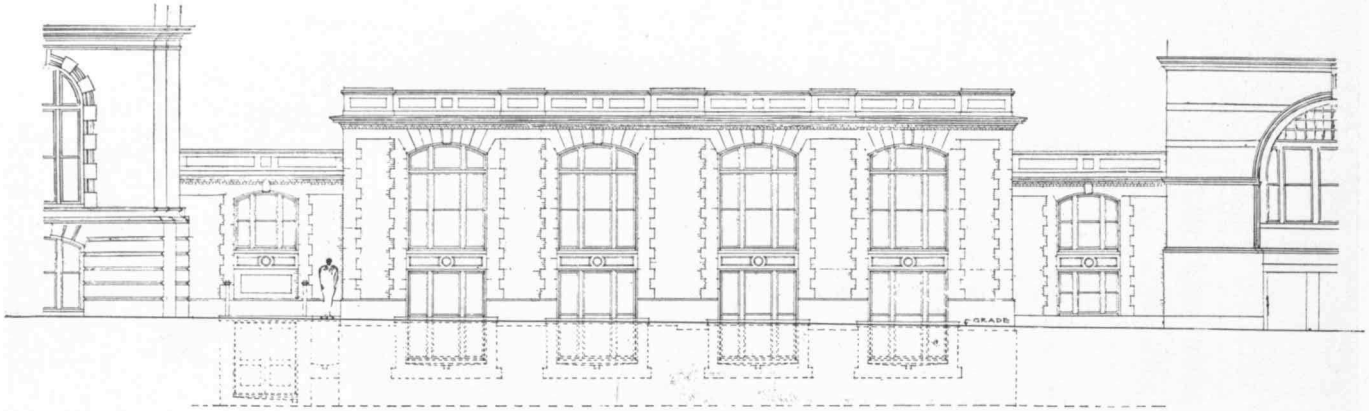
The Departments of Naval Architecture, Graduate Laboratories of Chemical Engineering Research and the Laboratory for blowpipe Mineralogical Analysis, have been accommodated in the portion of the building constructed this summer. The basement, or street floor, contains a large laboratory, 40 feet by 58 feet, for blowpipe analysis, with private office for the Instructor, one section of the room being provided with raised seats and desks as a lecture-room, the remainder being occupied by tables, cases, and hoods. A second large room, 29 feet square, also provided with raised seatings, will be used for a lecture-room jointly by the various occupants of the building. Three other class-rooms of moderate size, a shop and supply room for the Engineering Laboratory, and the heating and ventilating chamber take up the remainder of the basement.

Broad, easy stairs lead from the entrance corridors to the mezzanine floor, which is wholly occupied by laboratories, offices, seminar-room, supply-room, balance-rooms, photographic dark room, and other conveniences, so arranged as to be easily accessible from each other. A spiral staircase and dumb-waiter connect the supply-room on this floor with the supply-room and shop in the basement.

The next floor level, half-way between the mezzanine floor and the top floor, is over the Mineralogical Laboratory, and contains a large draughting-room for the naval cadets, a large private office and lecture-room for the Professor of Naval Design, and a lecture-room for ship construction.



Engineering "C"



ROGERS BLDG

ROGERS ANNEX
ELEVATION ON NEWBURY STREET
SCALE IN FEET

WALKER BLDG

RAND & SKINNER
ARCHITECTS.
BOSTON MASS.

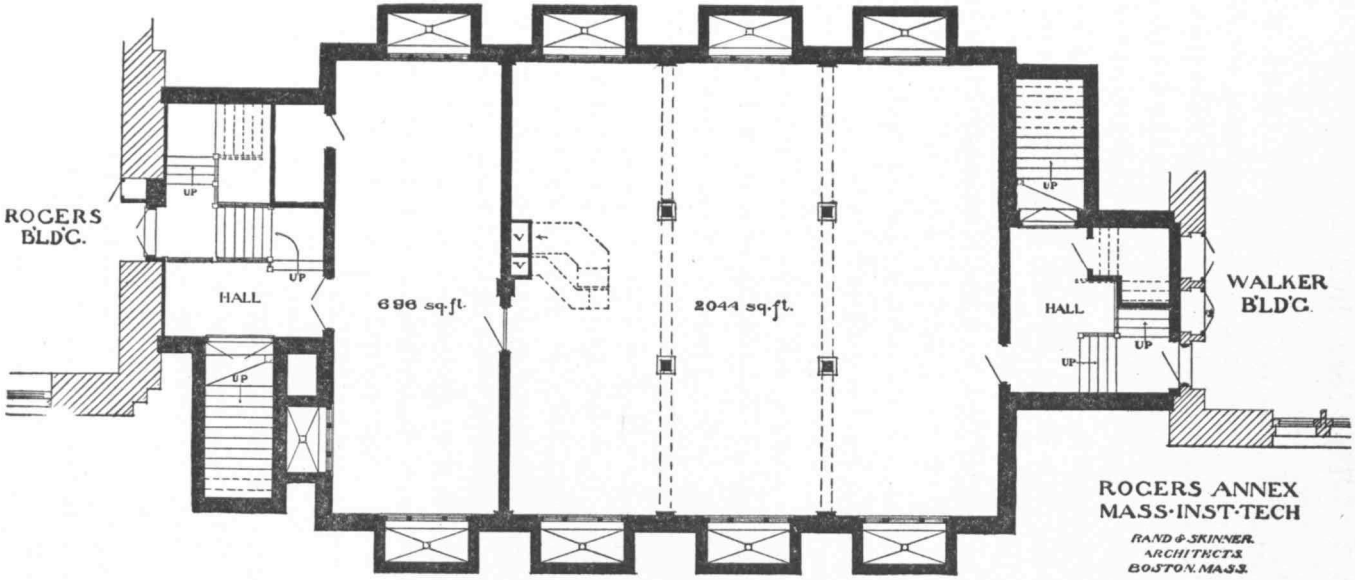
The upper floor, occupying the entire centre of the building, contains the general draughting-room for Naval Architecture, 58 feet by 70 feet, lighted from both sides and in the middle by a skylight. Adjacent to the draughting-room are three offices for the Professor of Naval Architecture and his assistants. Toilet-rooms have been provided on each floor, with ample fixtures for the accommodation of the occupants of the building.

Heat will be provided by a combination of direct steam with indirect coils in the basement, in connection with the ventilating system, which consists of coil, blower, and ducts, as is customary in the Institute buildings.

Electricity for light, for experimental purposes, and for driving various motors, will be obtained from the power plant in the Lowell Building adjoining, as will also the steam for heating, both services entering Engineering "C" through an underground passage connecting it with the basement of the Lowell Building.

Engineering "C" has been erected complete since the closing of the last school year, at an expenditure of about $40,000. The contract was signed on June 13, the erection commenced immediately, and the work has been rushed to completion on contract time.

Plans have been completed and preparations made for the erection of a further addition to the buildings of the Institute. A good idea of what is proposed can be gained by reference to Plates I., II. and III. This building will be an addition to both Rogers and Walker, but will be known as the "Rogers Annex," when completed. The plan provides for an extension of the Mining Engineering Laboratory toward the Walker Building on the basement level, for an extension of the laboratories of Walker toward Rogers on the same level, and for four consultation or lecture rooms in the first story.

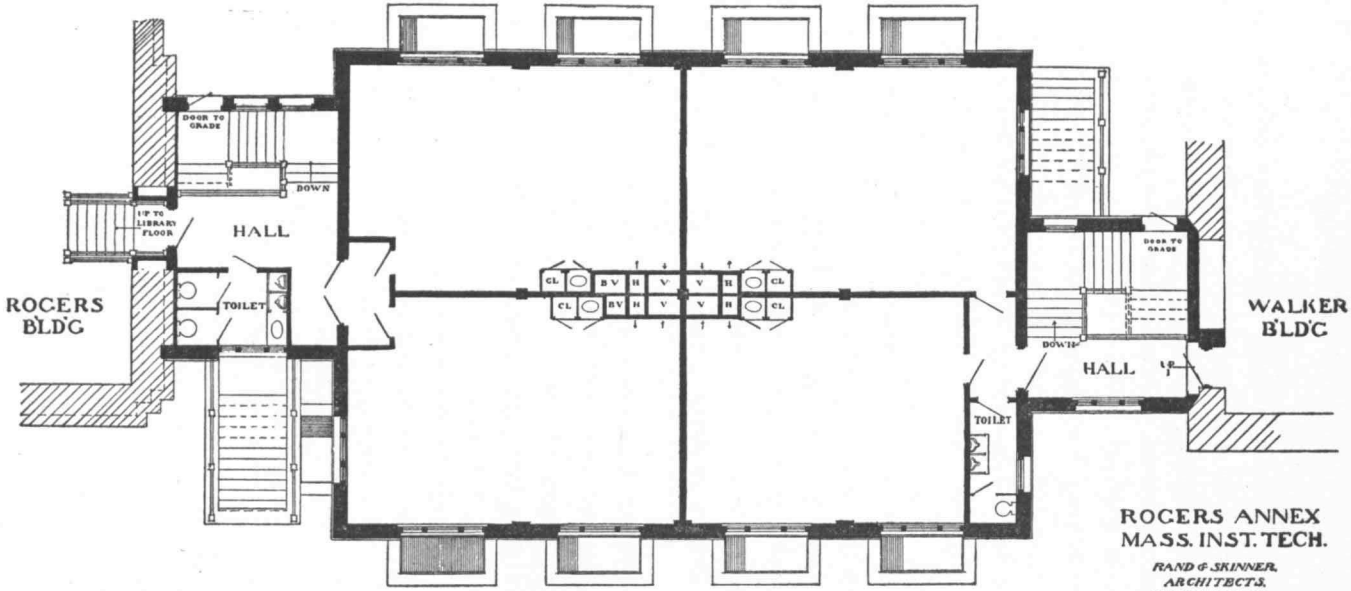

ROGERS
BLD'G.
UP
UP
HALL
UP
696 sq.ft.
2044 sq.ft.
UP
HALL
UP
UP
WALKER
BLD'G.
ROGERS ANNEX
MASS·INST·TECH
RAND & SKINNER
ARCHITECTS
BOSTON, MASS.
PLAN OF BASEMENT
SCALE IN FEET
0 1 2 5 10 15 20

The problem of connecting buildings as different in architectural styles as the Rogers and the Walker is difficult of satisfactory solution, but for a temporary one-story building the plan presented seems to close the gap, and to unite them without discord. By slightly separating the central portion, containing the higher and larger rooms, from the adjoining buildings by the introduction of stairways and toilets, into lower connecting portions, an architectural arrangement is made possible which, as seen by the elevation, carries some of the lines of both buildings through and interrupts others in such a way as not to make the break from one to the other too abrupt.

A new stairway will be constructed from the present reading-room in Rogers, to connect with the stairway in the annex, thus making a direct entrance into the library from Newbury Street without going entirely through Rogers corridor.

It is proposed to erect the annex in a substantial manner, with fireproof floor and roof, and to finish the exterior with as much and as good detail as would be done if the building were to be a permanent addition to the Institute. It will also be constructed with sufficiently strong foundations and footings to permit of the walls being carried, at some future time, to a height equal to that of Rogers and Walker, [see Frontispiece] if it should be decided to be not best to remove the Institute from its present location.

While working out the various problems as they have been presented, there has been borne home to the writer with great clearness the fact that a definite decision in the immediate future is imperative for the Institute; and that, whether to stay in its present location or to remove to a new site is the pressing question of the hour. If the Institute stays at its present location, the buildings which have



PLAN OF FIRST FLOOR

SCALE IN FEET

0 1 2 3 4 5 10 15 20

ROGERS ANNEX
MASS. INST. TECH.

RAND & SKINNER, ARCHITECTS, BOSTON, MASS.

recently been erected, in order to provide for the growth of the classes, will answer for a time, but will ultimately have to be replaced, and new work should be, as far as possible, of a permanent character. If a decision to move should be reached, the sooner the site can be determined and plans made for the removal, the better, as the present uncertainty makes definite planning impracticable. If a proper location within the limits of Boston could be found, the writer believes it would be best for the future good of the Institute to move, as land in the present location is too valuable to be held much longer for laboratory and class-room purposes, when ample ground can be obtained for a moderate price, where enlargement of the areas of laboratories could be made without feeling that the floors are paved with gold.

Several sites have been proposed and advocated by their proposers, each of which has advantages. Any of the sites proposed, no matter how inaccessible at present, could easily be brought within reach of our students and teaching staff and such portion of the public as wish to be in touch with the Institute, much more quickly than new laboratories could be erected and a removal effected. The transportation companies would be only too glad to extend their service, if necessary, to accommodate such a population as the Institute would bring.

It would be well to keep in mind in removing that, whatever locality be settled upon, the adoption of that site for the location of the Institute would be a great public improvement for the locality chosen, and, as adjacent land values would immediately rise, the Corporation should secure sufficient land at first to provide for growth as great as the most enthusiastic friend of the Institute can foresee.

THEODORE H. SKINNER, '92.

THE RELATION OF THE SCHOOL OF TECHNOLOGY TO GENERAL EDUCATION *

All men need general education: many have the capacity and the means necessary for that grade of general education called "collegiate." A minority — probably increasing — seek professional education also. The problem of the college is to harmonize, if possible, the interests of those who seek only general education and of those who seek both general and professional education. The corresponding problem of the professional school is to give the best professional training to students of various degrees of previous general education.

What constitutes general education? How much of it is so important that the school of technology should enforce its attainment? How much of it should be advised, but not required? Where and how should the minimum and the broader range be given?

As to the first two questions, I presuppose that general education includes the sum of those formative agencies of which the main object is quantitative and qualitative development of the powers and faculties of the student, without necessary reference to his efficiency in a particular occupation. I should include under it the study not only of literature, philosophy, history and art, but also of mathematics, physics and chemistry. A well-rounded general education should include all of these, and it should include also moral, physical and social elements. The educated man should not only have acquired a wide range of knowl-

* An address delivered at an intercollegiate Conference on the Relation of the College to the Professional School, held at Northwestern University, May 8 and 9, 1903.

edge; he should have gained power, self-mastery and the beginnings of wisdom.

The school of technology has the right and the duty to make its requirements of general education such that the aggregate value and efficiency of its graduates shall be a maximum, diminished neither, on the one hand, by too narrow training of a great number of men nor, on the other, by the undue restriction of numbers in consequence of a standard too broad or too high.

Of the elements of general education above mentioned, a great part — the sciences — receive greater emphasis in the school of technology than in the college. Moral, physical and social interests fare less well in some respects, better in others: the issue comes in part on the student's attitude toward his work as a whole, in part on the inclusion or exclusion of the literary elements of general education.

As to policy, the following alternatives invite consideration: —

First. The graduate of the secondary school may be examined for admission to the college only in subjects on which his professional course will depend, and the professional course itself may involve no recognition of literary studies as such. The graduate will have the minimum of general education, although the significance of chemistry, physics, mathematics, etc., as constituents of general education apart from their utilitarian aspects, should not be forgotten.

Second. The graduate of the secondary school may be examined more or less extensively and thoroughly in literary studies,— for example, English, history, modern languages, etc.; but his professional course may contain none of these. This seems to be based on the assumption that the professional graduate needs no literary education

beyond that which is within the capacity and maturity of the secondary scholar. On the other hand, it seems, if requirements are strictly enforced, to make the admission of candidates to professional courses depend to a relatively great extent on thoroughness of preparation along literary lines, on which success in the professional work will have but slight dependence.

Third. The professional school may attach such value to general education as to require an academic degree for admission. This gives high recognition to the value of general education, but seems to be open to serious objections which will be considered at some length below.

Fourth. The professional school may accept responsibility for general as well as for professional education, and, requiring literary as well as scientific subjects for admission, may undertake more or less successfully to combine certain fundamental elements of general education — for example, English, history, and economics — with its own professional instruction. The main difficulty of this plan is that of lack of time.

Fifth. The professional school, planning its courses for graduates of secondary schools, may at the same time make provision for college graduates to enter with advanced standing in such a manner that their total period of education shall not be unduly prolonged.

The Massachusetts Institute of Technology has based its policy on the fourth and fifth of these alternatives. From its standpoint the entire omission of the literary elements of general education is indefensible, and is certain to produce graduates whose professional efficiency — to say nothing of their value as citizens and as men — is confined within a narrow range. The attempt to meet the difficulty by enforcing the study of literary subjects in the prepara-

tory course alone must be ineffective, for the reason that the secondary scholar has in general not reached the age or intellectual maturity which justifies a suspension of literary studies. Such suspension leaves him with only the schoolboy's power of expression and appreciation of matters outside of his profession. It is an easy abdication of the professional school's real responsibility for general education toward young men who have not passed the age to which general education necessarily belongs.

On the other hand, the requirement of an academic degree for admission to the technological course may be a complete, but it is also an essentially illogical, remedy for the lack of general education on the part of technological graduates. It would perhaps be more accurate to say that this solution is not so much illogical as over-logical. Good results are claimed for the application of this principle to professional schools of older type in theology, law and medicine. I have no disposition to question the validity of these claims. I venture to deny that such success in the professions mentioned affords an adequate ground for putting technological education on a similar basis. If the lawyer needs a mainly literary and general education as a basis for his professional success, this does not carry with it any such inference for the mining engineer. Analogies are dangerous, but over against that of the lawyer or the doctor may be put that of the military officer. Would any one question his need of broad general education? Would any one suggest that he should be first a college graduate before being admitted to West Point?

The requirement of an academic degree for admission to the professional course seems indeed to have no very definite significance under present academic conditions. The

A.B. may mean a course primarily classical, but under the elective system it may mean almost anything else. The natural effect of an A.B. requirement for admission to all professional courses would seem to be the further dissolution of any definite significance as to content which the academic degree may now have, the further tendency to carry back courses in applied science into the academic curriculum, and the greater pressure for condensation of the curriculum. The students who take the college course for its own sake rather than as a basis for professional studies would be more and more subordinated to those who are preparing for professional courses. These latter, if wisely guided in the choice of electives, might well secure for themselves the best attainable education, devoting to it presumably not less than six years. I submit, however, that the requirement of an academic degree for admission to a professional course is not at all justified by a demonstration that individual students conforming to this requirement obtain through it the best education. The choice of the best should be free, not enforced. Any requirement involving six years of advanced study puts the professional course out of the reach of many students well fitted for success in it. Because professional schools have at times made the easy error of requiring almost nothing for admission,— and this is, I believe, not more true of the schools of technology than of those of law and medicine,— should it be inferred that the rational alternative is the opposite extreme of a complete academic course as preparation?

Another most important consideration is that of cost. The scientific professions of the country are recruited very largely from the families of poor men, and this tendency toward convection between social classes is of very great value. The cost of a technological education is necessarily

heavy. If an academic course were a prerequisite, many of the poor students would be entirely unable to take it. Many others would go beyond due limits of self-sacrifice and hardship, and would be permanently impaired in physical and mental efficiency and vitality. It is not impossible that in the diversified field of American education it may be desirable that there should be one or more scientific schools requiring college graduation for admission, but the practical application of the principle would be gravely hampered by dissimilarity in the attainments and scholastic quality of the students.

Under present economic and social conditions the American boy who desires to become an engineer, a chemist or an architect, wishes, with right, to enter the lower ranks of his profession as soon as may be after attaining his legal majority. He will have much to learn in these lower ranks from associates of more or less training than himself, much to learn by toilsome contact with products of his own industry and that of others, in the mine, the mill, and the field. He must learn by experience how to manage many forms of labor and service. Much of this apprenticeship differs radically from anything normal to the experience of the young graduate in law or medicine. The young lawyer or doctor prepares for a career of independent activity and responsibility; the young engineer is likely to become a member of a great industrial organism.

The development of pure and applied science, the inincreasing complexity of applications of the physical sciences in engineering and industry, render it wholly out of the question to give the essential training in a thorough manner in less than four years, assuming that the candidate has at the outset the best preparation which a boy of seventeen can expect to have obtained. Nor is this limit mainly

dependent on the relative efficiency of secondary education or the relative scholastic industry of boys. The work of the scientific school differs not merely in degree, but in kind, from that of the boys' school; and, if a particular boy under exceptional conditions is able to carry his preparation beyond the usual point, it still remains needful, if not imperative, for him to spend four years in the professional course. On the other hand, the average boy will very often find it important, if not essential, to give five years to that course.

The attitude which the scientific school can take toward literary education is thus limited by the following considerations: —

The boy can be presented by the secondary school adequately prepared for a professional course at about eighteen years of age; a professional course of normal scope can be given him during four years of earnest work; it is desirable that he should be ready to enter his profession at twenty-two, or, with some margin for advanced study or interruptions, at twenty-three. Shall the pressure of professional studies be allowed to prevent the reservation of a substantial portion of the four years for general, and in particular for literary, studies? The Massachusetts Institute of Technology has stood consistently for the negative answer to this important question. Its technical courses have been based on thorough and careful treatment of the fundamental sciences,— chemistry, physics, and mathematics,— presented not merely with reference to their applications, but with due regard for their intrinsic significance as essential elements of a broad general education. To these have been added thorough courses in modern languages regarded both as a means to acquaintance with the scientific work of other countries and as linguistic training.

Besides all this, every course has included a definite allotment of instruction in general studies of a literary character, in particular English composition and literature, American and European history, and economics. It is not claimed that these courses, under the pressure of competition with professional subjects, receive all the time and attention of students which might well be desired. It is held that the Institute by the maintenance of these courses recognizes, and, so far as practicable, fulfils its obligations toward the literary education of the great majority of its graduates. For many of them the relatively brief instruction in literature and history has proved a permanent nucleus for subsequent studies of later life. The significance of economics for any man who is to deal with industrial problems and processes on a large scale, with necessary reference to cost of production, needs no argument. It need hardly be added that literary subjects are required for admission, and it is significant that a recent considerable increase in the entrance requirements in French and German has been accompanied by provision that nearly half of the time set free in the curriculum by this advance should be reserved for studies of a general character.

The young man whose tastes and circumstances warrant a broader general education has, so far as the Institute is concerned, the choice of two plans, one of which is very commonly pursued. He may, first, extend his Institute course over five years instead of four, being classed nevertheless as a regular student, and thus find it possible to include a considerably greater range of literary study for which opportunity is offered in connection with the course in general studies. This plan has not yet been often followed. In the second place, the student may take an academic course at college in whole or in part, and then

enter the Institute with advanced standing. Such a combined course may under favorable conditions be completed in six years, or even in five years, if only the degree of the Institute, and not that of the academic course, is sought. The Faculty esteems highly the value of this plan, and offers very considerable latitude in its requirements as to sequence of studies to a college graduate endeavoring to make such a combination.

The present year eighty-eight graduates of forty-eight colleges and universities have entered the Institute in this manner. The advantages of the plan vary with the student, but may on the whole be summed up more or less accurately as follows: The student passing at once from the secondary school to the scientific school is apt to have already a tendency toward specialization in some technical line, which will often have detracted from his interest in general education. The direct transition to the professional school gives full effect to this tendency. The professional point of view is over-emphasized. Other lines of interest are neglected, and intellectual narrowness results. I do not at all admit that this is the general attitude of students coming to the scientific school without a college course, but I do not, on the other hand, deny that it applies to too large a minority.

As to the college course as a remedy, the argument seems to me two-sided. On the one hand, the boy of general intellectual interest and ability, systematically trained, may spend three or four years in an academic course with continually broadening mental horizon, with stimulating and inspiring relations with teachers and fellow-students, and with no lack of earnestness and effort. It need scarcely be said that this ideal is not the average. The boy graduating from the secondary school may have so strong a bent

toward professional studies that an interpolated general course would be uninteresting,— not to say distasteful,— particularly if not alleviated by freedom of election, while the principle of free election would logically have led to his following his own preference directly into the professional course. This difficulty would, I am confident, apply to a relatively large proportion of students who now take technological courses,— students not, to be sure, of the highest type, but often of marked capacity and professional promise. In the next place, the average boy of fair ability and industry without a decided bent in any particular direction, if he takes the college course as a preliminary to one in applied science, incurs certain more or less grave risks. If his course is mainly of a classical character, he may sacrifice time which he needs for the beginnings of scientific work. It is a serious misfortune for any student not to have had some laboratory work in the secondary school. Whether he has had it there or not, he ought on no account to postpone beginning it until he is past twenty-one. If he does this, he will then require more than normal time, he will undergo the serious embarrassment of entire dislocation between the grade of work which he can do with his brain and that which he must do with his eyes and hands. It is not at all unlikely that he will fail; for success in the scientific laboratory is not possible to all, and fitness for it should be tested early rather than late.

It has been assumed that the college course has been conducted under favorable conditions, but in a purely academic direction. It is not an open question, however, that for the average college boy, who is for the moment under consideration, conditions are rarely ideal. The whole atmosphere of the college or university is a complex mixture, not merely, or perhaps mainly, of studious effort,

but of athletics, fraternities, and miscellaneous pastimes. The college student may have learned to do nothing thoroughly well, and if he enter the scientific school after graduation, may be less fit to do its work than he was four years earlier. He may have learned to depend upon text-books rather than observation, on authority rather than on evidence, on the examination cram rather than on continuous application. He may have been esteemed most by his fellow-students for his physical prowess and his social good-fellowship. His perspective of the world around him may be essentially distorted. He may overcome even this handicap in the professional school, but the effort is painful and the risk of discouraging failure not small. On the whole, out of ten students who graduate in the scientific school, perhaps four would have been greatly benefited by an antecedent academic course, three more would have derived some benefit, but hardly enough to offset the expenditure of time, the remaining three would have suffered harm from the demoralizing possibilities of the college, or would have failed on account of natural unfitness for its work. The admixture of college graduates with undergraduates of the Institute has, in spite of occasional disadvantages, had on the whole salutary results. The undergraduates, outnumbering the others by far, have in general appreciated the superior maturity and mental breadth of the better men among the graduates. The graduates, on the other hand, have gained much from the spirit of earnest application surrounding them. It is certainly unpleasant for the college graduate to have to take first-year chemistry or drawing with Freshmen, but this is rarely necessary, if the college course has been well planned; and, if he enters the third year of an engineering course, the men of his class are not markedly inferior in maturity.

Statistics have been prepared showing the attendance of college graduates at the Institute, including all who have entered from 1890 to 1899 inclusive. Their records have been tabulated, and expressions of opinion have been sought from heads of professional departments as to the quality of these men as students and their subsequent professional efficiency. The total number of graduates for the years in question is two hundred and eighty-nine. The degrees held by them are as follows: A.B. (or B.A.), one hundred and sixty-eight; S.B. (or B.S.), sixty-eight; other degrees, fifty-nine; the number of colleges represented, one hundred and twenty-three. The number who have received the degree of the Institute is one hundred and fifteen.

The records of the Institute and the expressions of opinion on the part of the heads of professional departments seem to warrant on the whole the following conclusions: A considerable number of graduate students have come to the Institute, often as teachers for special purposes, with no expectation of completing any of its courses. These students have usually had professional experience of some sort, are past the usual age, and are of decided ability and earnestness. Their academic attendance has been of high value to the school, but affords no basis for argument along general lines.

Leaving these students out of account, leaving also out of account those who have come to the Institute as graduates of other scientific schools, it appears that the average quality of work has not differed widely from the average of the Institute's own students above the first year. A certain proportion of incompetents are naturally weeded out in the first year, and may be presumed to have been weeded out also by college graduation. The best of the

college graduates have done work entirely comparable with the best work of other students, but by no means superior to it. On the other hand, the college graduates have shown all degrees of incapacity.

As to subsequent professional success, data seem to be inadequate for any general conclusion. Prior to 1890 the number of such graduates was comparatively small. Those who have come since that date have not yet reached the age when superiority of fundamental equipment should have produced decided results. Immediate professional success is not more open to the college graduates than to the others. The real question as to their efficiency belongs to the period twenty-five years or more after graduation. The somewhat exceptional man who has laid a broad foundation of general education, and who has made the best use of the social opportunities of college life, may certainly be expected on the one hand to lead a larger and more useful intellectual life as a citizen and a man, on the other hand to have marked superiority in all those wider professional fields in which success depends greatly on knowledge of men and skill in dealing with them. Actual evidence in this direction is as yet, however, necessarily limited.

The relation between the independent scientific school and the professional university department may be considered briefly. In the United States independent schools of technology and the university departments have been developed more or less equally with a wide variety of intermediate types. In the East, where conservatism of colleges and universities has been relatively more potent, the importance of independent scientific schools has been greatest, and their success most notable. From the present standpoint the technological department of a great univer-

sity may offer to the academic graduate better articulation of his general with his professional studies. On the other hand, the independent scientific school can deal at least as justly with the graduate of the college which has no professional departments, and it is certainly open to question whether it is not wiser for a young man to divide a six-year term of higher studies between two different institutions than to pass from an academic department to a professional department of the same university. The decision of this question may naturally turn on a variety of special considerations; but not infrequently it may be highly advantageous for the student at the threshold of his professional studies to make an entire change of environment, as the German corps student does whenever his serious work begins.

It is interesting to note that the relations between the colleges as such and the professional schools of technology are becoming closer with the increasing tendency of the college graduates to seek the scientific schools. Both the colleges and the scientific schools have much to gain from this tendency; and both may well make whatever adjustments, and even minor sacrifices, may be needful. I have been specially interested the present year in correspondence with the president of a college, in connection with the publication by him of a circular on pretechnical studies for scientific students, outlining a course in college on the basis of which graduates may enter the third year of an engineering course.

Finally, to vary the point of view, if consulted as to the best course for a boy completing his high school and desiring a technological training, I should be inclined to advise somewhat as follows: Send the boy to college,

(1) If time permit;

(2) If he has the capacity for breadth of interest necessary to derive advantage from a wide range of opportunity, and the steadiness of character to insure a due proportion of work to play;

(3) If a college is open to him which shall not require Greek for or after admission, but shall offer him on the one hand moderate freedom of election, on the other hand good instruction in drawing, mathematics, metaphysics, physics, and chemistry, with laboratory work, as well as in the usual collegiate lines.

Under these conditions an admirable education for professional life may be completed at twenty-three or twenty-four, without truncation or distortion of either the college or the technological course. The more completely the last condition is fulfilled by the colleges, the more the existing articulation between the college and the school of technology is improved, the more will the former attract of an excellent class of students, the more will the latter gain of broadly trained men, the higher will become the standard of the engineering professions.

H. W. Tyler, '84.

THE EDUCATIONAL BEARINGS OF MANUAL TRAINING*

A friend of mine, who hated music, went once to hear the oratorio of "The Messiah." Describing it, he said that the chorus sang, "All we like sheep, all we like sheep," over and over, until sleep came to his relief. Then, in his dreams, he visited Europe, Asia and Africa, and experienced many adventures. Waking at last, he found the chorus still shouting, "All we like sheep," when, as a matter of fact, he declared, he hated mutton. Only after hours and hours, if one were to believe him, was that sentence finished by its necessary predicate,— "have gone astray."

Somewhat as Händel's florid music called for the odd amputation of that sentence, so the exigencies of programme printing demanded — with my consent — the curtailing of the title of my paper to-day. The programme assigns to me the impossible task of dealing with "The Educational Bearings of Manual Training." I will, if you please, lengthen my title but narrow my range by speaking upon "The Educational Bearings of Manual Training upon Co-ordination, Creativeness, Culture and Character." And I use alliteration, not for its own sake, but because those, to my mind, are the four important bearings of this many-sided teaching process which we summarize as manual training. Upon these educational foundations manual training can stand "four-square to all the winds of heaven," maintaining itself triumphantly against the cold north wind of blind opposition, the chilling east wind of snobbish "culture," the soft south wind of educational sentimentality, and the healthful west wind of intelligent conservatism.

* An address before the Eastern Manual Training Association, July 7, 1903.

Even the conservatives in matters of schooling are now agreed that co-ordination of the physical, mental and spiritual powers is at the basis of all real education. From the wild waving of the infant's arms and the ghastly rolling of his untutored eyeballs up to the skill and self-poise of a greatest leader of mankind, the educational process is mainly one of co-ordination, of adjusting this marvellous human mechanism, of training the will to take intelligent command of the physical, mental and moral powers. But complete co-ordination cannot be brought about so long as that side of the physical, of the mental, and — let us not hesitate to say — of the spiritual nature reached, and reached only, by manual labor is left out of account. It is self-evident that there must be lines and areas of co-ordination which can be completed in no other way. It is of no moment that I cannot make a ship-shape box or forge a respectable hammer; but it is of serious consequence to me that in my education the co-ordinative processes involved in the making of the box and hammer were left wholly out of account. Hand training would not simply have given me manual skill: it would have opened for me new channels of inter-communication; it would have unsealed for me mental and moral avenues now doubtless forever closed; it would have strengthened markedly my poise and power of will. From the block-building of the kindergarten to the highest development of the fine arts every manual process not purely automatic, every manual process which requires co-operation of mind and muscle, is an important step forward in that general co-ordination which is the main end, and in which lies the chief use, of all human education. Therefore, simply as an aid to co-ordination manual training would justify itself, were that the sole point of its educational bearing. As a matter of

fact, however, this is its most elementary utility. It serves much higher uses in bringing out individuality, in awakening desire for learning, in stimulating the will to take complete and wise command.

It is an observation as old as time that to arouse interest one must promote activity, that "to do is to know." It was not Froebel who discovered, but it was he who most clearly insisted, that the way to learn is to learn by doing. Out of this doctrine have grown those laboratory methods of teaching which, starting in the kindergartens and the technological schools, have invaded even the most hidebound colleges, and are sweeping up through the elementary and down through the secondary into that last stronghold of conservatism, the grammar schools. If, in teaching a child, one can make him actually do something himself, can lead him to create something really his own, then one has found a means surer than any other for arousing dormant and holding vagrant faculties, has opened a clear path to whatever capabilities the child may have, has established at least one point of contact between the trained individuality of the teacher and the, as yet, nebulous individuality of the growing child. But what opportunity did the old-fashioned curriculums offer for this important business of creativeness? They presented, as a rule, but one avenue,— and that the least likely for the child to follow,— the avenue of literary creation. Literary creation, however, is the most difficult of all arts, it presupposes the widest acquaintance with civilization and with life, it is one in which the child soonest meets insurmountable obstacles. Nevertheless, the old courses of study, feeling dimly the necessity for creativeness in education, set their pupils to the work of creating; and, as a result, we had in schools those worse than futile "compositions" on Faith, Hope or Charity, we had

in colleges that abomination of educational desolation, the writing of Latin verse. In both exercises the creative element was about as genuine as in the conversation of a garrulous parrot. If teased by fond parents to admire those compositions or those verses, because of their inherent difficulty, one felt like making rude Sam Johnson's reply to the mother who asked him to admire her daughter's harpsichord playing because of the difficulty of the performance: "Difficult, madam? Would God it were impossible!"

With manual training, however,— using the phrase so broadly as to include the feeblest "occupation" of the youngest flower in the kindergarten,— the immature faculties are not forced out of their normal path, the child is not compelled to lie to you and to himself by pretending to a literary power which he cannot have. One simply employs the natural instinct of the child to use its hands, one merely seizes upon that passion of most children to make something, one but leads into regulated channels the brimming enthusiasm of healthy youth for the bending and shaping of inanimate things.

One might show, of course, many directions in which the creative instinct stimulated by manual training serves, as no other educational process can, in the development of many a boy and girl; but perhaps the most far-reaching use is in unlocking and then in forming and strengthening individuality. The most pressing educational question is how to save the child's individuality, how to keep him from becoming a mere cog in the monstrous social machine. In our pride at giving free education to millions upon millions of children, in our delight at the smoothness with which the day's programme glides by, at the precision with which, so to speak, the pupils present arms to us their of-

ficers, we are falling into an easy but most dangerous uniformity, we are securing a quiet in our school-rooms that is too often the death-quiet of spiritual collapse. Such phalanx-teaching is not education: it is pedagogical militarism. Real education forbids such uniformity, and demands instead that every boy and girl during every school-day be brought within the personal view and understanding, within the sphere of direct, humanizing influence of the human man or woman who is, or ought to be, the child's teacher. The first step towards this real education is, of course, to secure smaller classes in the schools, and over those smaller classes to place, in every instance, teachers who know how to teach. But a second step (and it will go far) is to infuse into our school programmes, from the very first to the very last year of school, much manual training of many kinds. For manual training, of whatever type, cannot be done by battalions: it must be performed by individuals. Handwork cannot be slurred over in chorus: it must really be done, each piece and process, under the teacher's eye. A class in handicraft cannot be kept by any person with a voice harsh enough and an eye piercing enough to maintain cowed silence among seventy children: it must be supervised by some one who knows how, who can stand the tangible test of his pupils' handiwork, and who, since he must personally watch every child's work, cannot in the very nature of things be insulted by being told to educate — save the mark! — a greater number of human beings than is usually given of young pigs to a swineherd's custody.

Manual training, then, makes for the intensive development of the individual under the vigilant eye and the really educating mind of the individual teacher. But education should be extensive as well as intensive. It should first, of course, develop the individual along the lines of his in-

dividuality; but, having done that, it ought next to broaden that individual along the lines of human civilization. In other words, having brought the child to a knowledge of himself, it should lead him next to know the human race. From the cultivation of the single boy or girl, it should widen out to the culture of humanity. Therefore, the third educational bearing of manual training is upon the culture side.

To join culture — a fetish word as blessed to the conservatives as "Mesopotamia" was to the old lady — to manual training is to scandalize the tories in education, is to amuse that lessening class of men who blandly assert that no useful study can be cultural. Nevertheless, to culture in its true meaning manual training has a most important relation. For to have culture is not merely to be learned in the classics and in literature: it is to have a mind furnished with many, and many different, things; it is to have breadth of view, knowledge of the world, skill in dealing with men, ability to foresee and intelligence to grapple with the complex problems which meet one every day; it is to possess an agreeable, an equable, a tolerant personality; it implies tact; it means, above all, power to understand and to deal with men. But how is one to be really broad, how is one to be able to meet all kinds of men, how is one to know life as the really cultured man ought to understand it, if that whole side of his experience which should look out towards industrialism, towards that manual labor which lies at the foundation of all arts and livelihood and life itself, is little better than a blank wall? It is not to be maintained, of course, that skill in carpentry will unravel for a man the labor question or enable him to deal wisely with the problems of the industrial world; but he whose hands as well as his memory and judgment have been trained, he who has actually labored and has had experience, on how-

ever small a scale, of what the industrial processes involve, — he is a far broader man, is a far more liberal man, is a far more all-around man, than one who has simply been delving, no matter how deeply, into literature, philosophy and abstract ethics. The former may possess less knowledge than the latter of the humanities, but he will know more of humanity; and culture, in the modern understanding of it, is the science and art of living wisely and nobly with and for one's fellow-men.

Fourthly, manual training bears strongly and with excellent effect upon that goal of all education,— character. This follows naturally from its lesser function as a co-ordinative force. To educate is to co-ordinate; and to co-ordinate is to put the powers of the body and mind more and more under the command of an intelligent, a purposeful, an upward-striving will. What, indeed, is a formed character but one in which all the functions, all the thoughts, all the motives, all the desires, are marshalled, ruled and inspired by a strong and well-balanced will? To have taken a piece of wood and compelled it to the shape that lay in one's mind or upon one's paper, is not that an exercise in will-strengthening of the highest educative value? To forge the iron, to carve the wood, to mould the clay, to draw the design, to conceive and to impress the pattern, is not each one of these a healthful, really educational development of will-power, accompanied by that sense of pleasure which comes from the act of construction, by that still higher delight arising from the contemplation of one's own finished work? And let us note, in passing, the tremendous advantage of manual training as an educator of the will, in that its results do not have to be explained or accepted upon faith or looked forward to in some far future of postponed rewards. With

the work of one's hands the effort, often hard and disagreeable, is followed immediately by its result, good if that effort has been earnest and genuine, bad if that effort has not been sustained and real. Every piece of handwork preaches to the child, in tones which he cannot fail to understand, the awful law of cause and effect, the immutable law that "whatsoever a man soweth, that shall he also reap."

These, I maintain then, are the four chief bearings of manual training upon education. Rightly conceived and carried on, it promotes co-ordination, it develops creativeness, it broadens culture, it strengthens character. What are some things essential, however, in order that it may do its perfect educational work in these four directions? In order to further co-ordination, manual training in some form — and its forms are protean — must have an integral place and an uninterrupted sequence in the curriculum from the earliest kindergarten to and through the university. Co-ordination is not a process to be taken up to-day and dropped to-morrow; and, if manual training is to play a vital part in co-ordination, it must not be chopped up and scattered about to suit fanciful programme-mongers. It must be built up logically and developed wisely, to serve the needs of a real, organic education.

Next, to fulfil its function as a stimulus to creativeness, manual training must really create something: it must produce things of use, things of beauty. The child or the youth, when set to work with tools, is not satisfied merely to learn an abstract principle: he seeks to do something tangible; and it is educationally right that this craving should be gratified. His teachers must make certain only that this tangible creation of his is really useful and is truly beautiful with that genuine beauty which grows out of the fitness of an object to its purposes.

Thirdly, to fulfil its culture function, manual training must be representative of the life of the child's house and of its neighborhood, of the atmosphere of his town or city, of the larger genius of his nation and his race. It must identify the child closely with the general industries of his people, with the special industries of his community. It must connect him, hardly less closely, with the industrial and social history of mankind, with that age-long history of which his own developing life is the inconceivably rapid epitome. Above all, his training on this side must be towards genuine craftsmanship, towards the making of true things solidly, of solid things beautifully. The use of what he makes, the beauty of what he makes, must ever be clearly before him; and use and beauty must be made to dwell, inseparable, in his thoughts and his ideals. In this way will he come, better than in any other, to a real conception, to a genuine appreciation, to a true understanding of æsthetics, and of the close interdependence of the æsthetic and the ethical.

As to the fourth bearing of manual training, its bearing upon character,— I have already dwelt upon it. We cannot do good handwork without sticking to honesty and truth; we cannot, in manual training, hide or equivocate or slide over. The good work we do is there, the bad work we do is there, plain for all the world to see. And every effort made in such training is a discipline of the will, every success is a strengthening and stimulus of that will, every failure — if the child be good for anything — is a trumpet-call to the renewal of that fight in which, if good character is to result, the will *must* gain the mastery. The splendid opportunity of the manual trainer is that he may by his teaching prove what Browning said, that

> "It is the glory and the good of art
> That Art remains the one way possible
> Of speaking truth."

What, then, are some of the things which manual training must work for and must secure if it would take its rightful place among the great educational agencies of modern civilization? As was said in the beginning, even the conservatives acknowledge co-ordination to be at the foundation of all education; and a very little effort ought to persuade them of the value of manual training as a co-ordinative force. Therefore, the first thing to demand would seem to be continuity in manual training throughout the whole school life. What have we now? Excellent manual training in the kindergarten (when it is carried on for the simple reason that it is good for the child to create, and not in deference to some far-fetched symbolism). We have excellent manual training in some secondary schools. In the years between we find some coherent, much incoherent, drawing; we find here some sloyd, there some cooking, elsewhere some sewing, and, scattered hither and yon, various more or less mad experimentations of sundry cranks and school committees. Most of these experiments are tried one year and are abandoned the next, are hotly pursued by one committee and are roundly denounced by its successor. But in this is neither cohesion of plan nor co-ordination of result. Secondary school men may lay out good courses; but, as a rule, they are superstructures without foundations, hanging in educational air. Those courses ought, however, to be the culmination of eight years of wisely planned, steadily pursued, widely varied manual training exercises. The pupils coming to a high school should not there first meet with tools; these children should have been uninterruptedly using their hands

to create, just as they have been using their tongues to speak, from their earliest day at school. Manual training cannot promote co-ordination until that training itself is made co-ordinate.

Furthermore, it seems to me, manual training ought to stop apologizing and ought, if it must, to come out and fight. It was perhaps necessary, away back in the seventies, for this new kind of study, like the genius imprisoned in Sinbad's bottle, to speak low and make fair promises; for it was indeed corked up tight by that then master of the educational situation, the nine-centuries-old monastic curriculum. It was probably the part of wisdom for manual training at that time to swear that it had no thought of being useful, that it did not dream of connecting itself with vulgar trades, that it would deal with principles, not with practices, that it would teach the driving of nails, but not the making of a living. That probation period, however, has gone by. The bottle has been uncorked, the genius of manual training, or, rather, of laboratory methods, has come out, and has expanded to enormous proportions; while before it kneels the old curriculum, in its turn apologizing for existence, in its turn begging for the right to live. The "humanities" may not like manual training any better than they did thirty years ago; but their dislike now is the hate of fear, not of supercilious arrogance.

Being, then, practically masters of the educational field, why longer maintain the fiction of academic uselessness, why longer declare that manual training intends to be only disciplinary, not economically serviceable? Its use, as I have tried to show, is superlatively in the direction of physical, mental, and moral discipline; but its power in those directions will be infinitely greater if it allies itself with life, with industry, with bread-and-butter getting.

For, after all, every one of us must get his bread-and-butter, the great majority must earn it by their own two hands. No school education, praise Heaven, can be so bad as to defraud us of the lifelong schooling of our daily toil. But during all these centuries (thanks mainly to its monastic origin) education has been acting as though it could stand apart from life and livelihood, has been holding itself aloof from the boy's and girl's real interests, has been covertly sneering at manual labor, has been filling thousands and tens of thousands of honest youth with a vague notion that the educated man can be a sort of lily of the field which, having arrayed itself in Greek and Latin, need neither toil nor spin. Therefore, we see such a host of starveling clerks, pettifogging lawyers, and political hangers-on, therefore we find it well-nigh impossible to get a good mechanic, therefore we observe the tendency of craftsmanship — once jealous of its skill and reputation — to seek short hours and shoddy ways of work. The present curse of this country is glue. With it we stick senseless jig-saw work upon our furniture, foolish gew-gaws on our "Crazy-Jane" houses, hideous *passementerie* (I think they call it) on our slop-shop gowns, demoralizing smatterings of false culture upon our boys and girls. Manual training, if it will, can carry on a crusade of the noblest kind,— a crusade against this spirit of veneer, sham, hypocrisy; a crusade against any ornamentation, culture, or virtue that is only stuck on; a crusade for that real beauty— whether in craftsmanship, in art, in architecture, in literature, in social and political life — which grows out of the honest dedication of anything, no matter how homely or common, to a noble use; a crusade against false, monastic, anti-social, self-centred culture; a crusade for real culture, which, as I have already said, is the science and art of living wisely and nobly with and for one's fellow-men.

To these ends, it seems to me, manual training must go into every school; and it must go, not as a fixed plan of study, but as a special means of meeting the particular needs of that school's children. What, it should ask, is the prevailing industry of this city, what the peculiar craft of this neighborhood, what are these particular boys and girls almost certain to be and do? Having ascertained these facts, manual training can then perform an educational work such as has scarcely yet been dreamed of in ennobling those industries, in uplifting those children's ideals, in marrying education to life, in wedding true culture to genuine industry.

To perform this great work, however, manual training has still another fight to wage,— a fight against the absurd distinction between the arts called useful and the arts called fine. There is and should be no such discrimination. No art is fine which does not, through its beauty as through an enhancing veil, exhibit its fundamental use. No art is useful which does not, even in its simplest forms, mount into the empyrean of the fine. Beauty and truth are one and the same, and every exercise in manual training should emphasize both. The great fields of ethics and æsthetics can be reached through other avenues than Greek and Latin; but we have scarcely yet surveyed these avenues, while we have allowed the old classical paths to be overgrown with grammatical and philological weeds. One of the broadest of the modern avenues to ethics and æsthetics is through manual training, whose possibilities as a true culture study are, in my opinion, almost wholly undeveloped. For in most instances the manual trainers have avoided use lest they offend the educational tories, have failed of beauty because, first, there cannot be beauty without use, and, secondly, because æsthetics has been *terra incognita* to the

well-meaning mechanic-teacher, who, given a task to which he was unequal, has been as ignorant of child training as of true manual art.

This brings us to the final, and what all educators know to be the crucial, problem of the manual training question: how to get teachers fit for the splendid work that they might do. In the beginning resort had to be, of course, to the ranks of the skilled mechanics,— sincere men, well-intentioned men, men seeking to do the best they could. But they were not trained teachers; they were hampered by the absurd restrictions against usefulness in manual training; they were obliged to build for the high-school pupils whom they taught a superstructure without educational foundations. So there resulted something which was well called *shop-work;* for it was little other than the 'prentice work of any shop,— interesting, somewhat stimulating, better than nothing. But it was not and is not manual training in the sense in which we see its splendid possibilities; it could not, in very great measure, aid in co-ordination, stimulate creativeness, promote culture, or build up character. For that true work of manual training the schools must have broadly educated, completely trained, highly inspired men and women, who see the many bearings of manual training upon life and character, who are wise in art, in ethics, and in that offspring of art and ethics which men call æsthetics. There are many such teachers now. When such are in the majority, manual training will surely be extended into all its many educative forms, will be then made continuous throughout the whole school life, will be then uplifted to its rightful place as the strongest single teaching force of modern times.

James P. Munroe, '82.

REVIEW OF THE REPORT OF THE CHARLES RIVER DAM COMMISSION

The report of the Commission on the Charles River Dam is at last in print, fairly bristling with statistics and tables, and illuminated with prints and plans. It is a document of five hundred and eighty pages and twenty appendices, the work of a corps of experts,— a perfect tome, carrying conviction by its weight, of information as well as avoirdupois,— a fitting climax to the long years of investigations and reports and protracted inaction. The fact that this report has substantially closed the wearisome discussion, and silenced the opposition to this much-needed public work, is significant; and a careful study of the report — for it merits study — leaves a sense of pride in the work of our Massachusetts Commission. The importance of this investigation to the general public, and the part played in it by Technology men; the genius of the guiding spirit, Mr. John R. Freeman (in whose career this investigation fairly marks an epoch); the admirable and thoroughly scientific character of the investigation, which distinctly advances sanitary and hydraulic science and adds to engineering data; and the explosion of certain old and time-honored theories,— all go to make this report a most noteworthy one. It is of interest to note, too, the advantages which this committee has had over previous commissions, not only in more liberal appropriations, making careful study possible, but also in recent advances in knowledge along biological lines, of which the chief engineer has made full use.

If the report does not read like a romance, it will at least be found of genuine interest to the general reader, as well as to specialists in various lines; for there has plainly been an effort to describe the investigations and to set forth the lines of reasoning from them in terms that may be grasped by the non-technical reader. Hence the report has seemed to the editors of the REVIEW to merit somewhat extended notice; and, if the report of the commissioners is dwelt upon at somewhat greater length than the

report of the chief engineer and his corps of able assistants, it is not from any lack of appreciation of their splendid work, but rather on account of the difficulty of reviewing and bringing within the available space of the REVIEW a digest of the mass of scientific data and theories adduced. The interested reader will seek the report itself.

The project of building a dam across the Charles River has been discussed for more than forty years, or since 1859. An act was passed in 1870, providing for the establishment of a Metropolitan Park Commission for the purpose of improving the basin by a dam, as proposed by the late Mr. U. H. Crocker. This act was, however, rejected. "In 1891 the Hon. Nathan Matthews, then Mayor of Boston, in his inaugural address recommended the creation of a water park out of the basin, and, in view of the private interests involved, suggested that the whole matter be considered by a State commission. The Charles River Improvement Commission was thereupon appointed, under Chapter 390 of the Acts of 1891, for the purpose of considering what improvements could be made in the Charles River basin between the dam at Watertown and Charles River bridge at Boston, and submitted two reports, dated Feb. 21, 1892, and April 20, 1893, respectively. Both reports recommended embankments along the river, and the second recommended more specifically the discontinuance of the railroad bridges and their concentration in a new high-level bridge without draw."

The legislature of 1893, without acting on these recommendations, appointed a Joint Board, consisting of the Metropolitan Park Commission and the State Board of Health, with instructions "to investigate the sanitary conditions and prepare plans for the improvement of the bed, shores, and waters of the Charles River between the Charles River bridge and the Waltham line on the Charles River, and the removal of any nuisances therefrom." This Joint Board reported in April of 1894, recommending the building of a dam and lock about 600 feet above Craigie Bridge, by which a constant level in the basin would be maintained at about grade 8 (approximately 7 ¼ feet above mean low tide and 2½ feet below mean

high tide). The legislature referred the report of this board to the Harbor and Land Commission, with directions "to inquire into the construction of a dam and lock in the tidal basin of Charles River, as proposed by the Metropolitan Park Commission and the State Board of Health, sitting as a Joint Board, with special reference to interference with tide water and its effect upon the harbor of Boston." After protracted public hearings in 1894, held by the Massachusetts Board of Harbor and Land Commissioners, in which they apparently forgot what they were there for,— the consideration of the effect of the dam on the harbor,— and reopened the sanitary questions already passed upon by the State Board of Health, this board reported against the recommendations of the previous Joint Board on account of the conflicting character of the testimony and the lack of specific information on certain vital points.

In 1898 the legislature authorized and directed the Metropolitan Park Commission to construct and maintain a dam, with suitable locks, across the Charles River, at or about St. Mary's Street; but no action was taken under this authority. In 1901 the legislature authorized the appointment of the commissioners now reporting.

Under the Massachusetts Resolves of 1901, Chapter 105, the governor was authorized to appoint a commission of three suitable persons to investigate and report upon the feasibility and the desirability of constructing a dam across Charles River between Boston and Cambridge in the vicinity of the bridges known as Craigie Bridge and West Boston Bridge, and to report to the next General Court. The act provided that, if the commissioners should conclude that the proposed dam was feasible, they should recommend a plan of apportioning the expense of constructing and maintaining it between such cities and towns as would be especially benefited by it, and that they should annex to their report the draft of a bill in harmony with their recommendations.

A committee, consisting of Messrs. Henry S. Pritchett, Samuel L. Mansfield, and Richard H. Dana, was appointed. No stronger committee for safeguarding the interests of the community and the safety of the commercial interests in the harbor could

have been named. Dr. Pritchett had for three years been superintendent of the Coast Survey, Colonel Mansfield was for years the United States engineer officer in charge of the improvement of Boston Harbor, and Mr. Dana had long been held in high esteem in the community as a safe trustee of important interests and a citizen of broad views. Mr. John R. Freeman was appointed chief engineer.

The committee began by requesting each of the boards of public works of the municipalities bordering on the basin to consider how the construction of a dam would affect their present and prospective parks, sewers, streets, etc., and followed this by a series of twelve public hearings. A noteworthy incident of these hearings was Dr. Pritchett's insistence that the expert evidence should be submitted in the form of written reports instead of by the time-honored tedious method of question and answer.

Eminent experts for the proponents and the opponents respectively presented opinions diametrically opposite; and the good citizens who urged the dam were met by other good citizens who feared that the malaria from the proposed stagnant pool would drive them from their houses on Beacon Street, and others who feared for the shoaling of the harbor when the daily surging back and forth of this tidal prism was cut off. A volume of evidence and arguments, comprising 553 closely printed pages, resulted, and many maps were collected; and this almost hopelessly tangled mass was turned over to the chief engineer, Mr. Freeman, to unravel, with instructions to go to the bottom of things, and try to get evidence that should be so complete and convincing that it would settle the question one way or the other for a generation.

The committee availed itself of all the data previously gathered, and addressed itself to the solution of the problems raised by the Board of Harbor and Land Commissioners, and to certain other important questions brought out in the evidence before them and that arose as the studies advanced.

The sanitary questions were first and foremost, and required a study of the circumstances under which malaria is developed,— an accurate determination of the quantity of polluting material or

sewage entering the basin, a measurement of the flow of upland water available for diluting this sewage, the reasons for the foul condition of the Fens (which, it was claimed, were a fair prototype), the question of whether a salt-water basin would be more agreeable and sanitary than a fresh-water basin, and the question of possible injury to the harbor. These studies necessitated the accurate hydrographic and geological charting of the Charles River basin and Boston Harbor, a survey of the region with reference to present sources of malaria, and a careful chemical, biological, and bacteriological examination of the water at various points. While these studies made necessary the postponement of the date of the final report to the General Court, all will agree "that the results set forth are based upon examination sufficiently full and accurate to afford safe conclusions."

The Charles River basin occupies the centre of the Park Systems of Boston, Cambridge, and the Metropolitan District. For a distance of nine miles from the Watertown dam to the Craigie Street Bridge the land bordering upon the river is being developed for park purposes, excepting only a small area still controlled by private interests and devoted to canals and commercial purposes. Already $3,685,000 has been spent upon these improvements, and the West Boston Bridge, now under construction, will involve a further outlay of $2,500,000. Fortunately, this structure * has been designed with due regard to its architectural effect, which will be greatly enhanced by the proposed changes.

Residents of Boston and Cambridge are familiar with the unsightly appearance of the Beacon Street back alley, the long stretches of salt marshes and muddy flats, and the sewage-polluted Fenway pond fed by Stony Brook, which has been transformed by the influx of sewage into a natural "septic tank." The unsanitary conditions have long been recognized by the several boards of health, as well as by the residents of the districts; and measures are already under foot for their partial abatement. But, if the dam should not be built, it would be necessary, in order to adapt the river to park requirements, to dredge the unsightly and unsanitary flats in the lower portion of the river basin to a depth of five feet below mean

* See Technology Review, vol. iv. p. 1.

low water; to make certain changes in the sewage and storm-water disposal systems about the basin; to build further walls and embankments; and to improve the banks and tidal marshes by various means. After such work was completed, the river as a tidal stream would still present an unsightly and unattractive appearance for much of the time. Its use by the public would be limited, and its possibilities as the main feature of the park system would be only partially utilized.

The proposed dam and its auxiliary structures provide what it appears will be an almost perfect remedy. The chief reasons for the construction of the dam are to be found in the sanitary betterment of the region itself, and in the value which such a basin would have in relation to the Boston, Cambridge, and Metropolitan park systems.

As to the feasibility of the project of constructing a dam and maintaining a fresh-water basin at constant level on the Charles River during the entire season, the commission finds no insurmountable difficulty, provided that the dam be built at a sufficient elevation to exclude high tides and be supplied with a suitable lock for the accommodation of river navigation.

"It would be a great addition to the attractions of the city, and would lend itself to a plan of improvement which, in the long run, cannot fail to make Boston one of the most beautiful cities in the world. The creation of such a basin would give the cities of Boston and Cambridge, practically without expense, an open park area of one thousand acres, the lower portion of which is situated in the heart of the most congested metropolitan district."

"The Committee feels, under reasonable conditions, it ought to become the scene, for at least four or five months of the year, of a great popular playground.

"There is no reason why the Charles River below Watertown dam, with the water at a constant level of not less than grade 8, should not offer the same opportunity of use by the public both for a water highway and for purposes of pleasure and recreation which is furnished by the Charles at Riverside, the Thames at Henley, and the Alster at Hamburg."

"There can be no question that a basin of clear water, held at a constant level, with attractive banks, is in every way desirable. The questions which your Committee feels called upon to answer are: Can this basin be kept reasonably sweet and clean? Can it be maintained with advantage to the sanitary interests of those who live upon the river banks? Will such a basin be prejudicial to the great interests of Boston Harbor, or to possible commercial interests in Charles River? And, if these questions can be answered in the affirmative, it then remains to determine whether all this can be done within a limit of cost consistent with a just public policy."

Therefore, it became necessary to study most carefully the sanitary questions involved in building a dam across the Charles River at a point where the large volume of water in the basin would make the size of the stream entering from the uplands comparatively insignificant, and give what would be popularly called a stagnant pond. Upon this general question as to the relative capacity of quiescent and running water to dispose of pollution, Mr. H. W. Clark, the chemist of the Massachusetts State Board of Health, reported that "the popular belief that running water purifies itself more readily than still water is fallacious. It is found to be the fact that, with oxygen present and equally good conditions for proper bacterial growth, the still-water purification is fully as energetic." Professor Sedgwick says, "Modern science has reversed the tenet of thirty years ago, and now unhesitatingly affirms that it is quiet water rather than running water that purifies itself"; and the engineer of the Massachusetts State Board of Health, Mr. Goodnough, says, "Sewage discharged into a pond or slow-moving stream, such as the proposed Charles River Basin, has a less noticeable effect than an equal volume of sewage has upon a rapidly moving stream of equal volume." The discharge of the river at the Watertown dam will probably average seldom less than seventy cubic feet per second in the dryest portion of the year; but in an extreme drought, such as may be expected once or twice each twenty years, the flow of upland water under evaporation and the abstraction for certain public water supplies may shrink to twenty cubic feet per second, and possibly to ten feet, and this small flow

will be fouled or discolored by its use as wash-water for the bleachery and dye-works at Waltham and the paper-mills and dye-houses at Watertown.

The water of the Charles River at the Watertown dam is ordinarily of good quality, nearly colorless and well supplied with oxygen. It does contain some manufacturing waste impurities, as well as sewage pollution, even at this point, and will receive further sewage contamination during the dry months of the year, to the extent of 3 per cent. of the volume of the sewage produced in its drainage area in Cambridge and Boston.

"Notwithstanding the amount of sewage that enters the basin even at present, which our chief engineer estimated is equivalent to the constant discharge by a population of from five to eight thousand people, including that which comes from the Fens and from the Beacon Street houses, it is the unanimous opinion of the engineers and experts of the committee that a fresh-water basin, owing to its supply of oxygen and its large area, would not affect injuriously the health of the inhabitants in the neighborhood." Moreover, the plan of the engineer contemplates marginal conduits or sewers by means of which the greater part of the present pollution will be prevented and better circulation in the Fens and canals be induced.

The relatively small inflow of fresh water into the basin during the dry season, which was estimated to effect a complete change of water about once in three months, suggested to the board of 1894 the possibility of allowing a certain amount of salt water to enter daily; and this suggestion, together with the project of large tidal sluices for emptying and refilling the basin in a single day, recommended by certain of the proponents in 1902, called into question the relative efficiency of salt, brackish, and fresh waters in disposing of pollution and maintaining a biological balance between such growths as were likely to prevail in the basin. In regard to the relative efficiency of fresh and salt water for disposing of sewage, the engineer finds that fresh water, gallon for gallon, can dispose of more sewage than salt water, the tendency of the latter being to precipitate the sewage as sludge at the bot-

tom, where it soon exhausts the dissolved oxygen in the water and undergoes putrefaction. For the rapid disposal of sewage in water an ample supply of oxygen is essential. This is obtained largely through the contact of the water surface with the air, coupled with the action of vertical currents, dependent upon local conditions and temperature changes, and through the agency of proper aquatic growths, such as the algæ, which, feeding upon the nitrogenous matters that find their way into the basin, after these matters have been acted upon by the bacteria, give off in their turn considerable quantities of free oxygen, which supplements the oxygen brought down from the surface.

Where salt water and fresh water are brought together, the salt water tends to remain under the fresh water, owing to its greater specific gravity; and its free oxygen is soon absorbed. Its further oxygenation and consequent purification is prevented by the lack of vertical circulation. For this reason the mixture of salt water with fresh water is injurious where there is pollution to be absorbed. Moreover, the alternate changing from a fresh to a salt water basin would interfere with those bacterial growths which aid in taking care of and digesting the sewage.

The contention that "there is a large inflow of salt water into the Charles River basin directly from the ocean twice every twenty-five hours" is not sustained. The water in the estuary of the Charles surges back and forth day after day, and only gradually finds its way back to the sea. It is on an average eight degrees warmer than at Boston Light; and, while it is somewhat better at high than at low tide from a chemical standpoint, bacterially it shows little improvement.

That the water temperature would be raised from three to four degrees Fahrenheit in the new basin is shown by the engineer's report; but a most careful and long-continued series of observations with standard thermometers and thermographs has demonstrated that there is no foundation for the claim that in warm weather the present tidal basin lowers the temperature of the air in the territory adjacent to it to any noteworthy degree.

The level of the ground water in the Back Bay would not only

not be raised by maintaining the level of the basin, as proposed, but the periodical damage done under existing conditions by the backing up of the water in sewers in flood-times would be obviated.

Upon the malaria question and its medium, the *anopheles* mosquito, the pathological expert of the commission finds that by abolishing the present shallow and stagnant pools of fresh or brackish water along the margins (now forming natural breeding-places for these mosquitoes), through filling, sloping, and draining the margins in connection with the construction of the new and deeper fresh-water basin and through the presence of fish, the conditions are likely to be materially improved.

One of the most original and important lines of investigation pursued by the engineer was that bearing upon the question of tidal scour and the supposed injurious effect that might result from shutting off the portion of the Charles River basin now subject to the action of the tides, thus reducing the so-called "tidal prism." Government engineers and those who have had to do with tidal streams have long maintained the theory of the tidal scour of harbors, which, briefly stated, is that the depth of harbor channels is maintained, or at all events largely influenced, by the volume of water passing in and out on successive tides, owing to the velocity of the discharging current and its erosive and carrying capacity: hence any reduction in the tidal reservoirs has been viewed with disfavor, and, as far as possible, prohibited. That long-accepted theory, as applied to the maintenance of Boston Harbor, and under which the State has collected a large fund for harbor improvements, by exacting for every pile driven and every solid pier or other encroachment a sum estimated as sufficient to dredge out an equal volume, the commission has felt itself "obliged to reject," and has found "to be wholly erroneous." The geologist, Professor Crosby, has concluded "that the surging back and forth of the tidal prism has done more to shoal the harbor as a whole than it has to deepen it"; and the engineer calls attention to the fact that the conclusions of the United States Commission on Boston Harbor, which from 1859 to 1866 made ten reports to the city of Boston on the subject of the scour in Boston Harbor, rested largely upon

the experiments on erosion by the Dutch engineer, Dubuat, made in 1780. These experiments carried on in little wooden channels, 1½ feet wide by 1 foot deep, have little significance when applied to large streams or channels in natural, compact materials, particularly in a glaciated region. The velocity of the currents necessary for erosion under natural conditions has been found by that eminent engineer and veteran observer, Mr. Hiram F. Mills, to be much greater in actual practice than the velocities given by Dubuat. Mr. Freeman's description of the methods pursued by him to get definite information upon this subject,— facts, not opinions,— and the data collected by him upon which the conclusions of the commissioners were based, will be found most interesting to the students of hydraulics and geology.

Lieutenant Colonel W. A. Jones, of the United States Engineer Corps, in reporting upon Mr. Freeman's facts and deductions, pertinently remarks that, even if the tidal scour of the harbor channels were to be seriously affected by this further reduction in the tidal prism, the injury could be much more than compensated for by the development of those tremendous forces in modern harbor work,— the modern dredge and high explosives.

Moreover, "the Charles and Mystic Rivers are not silt-bearing streams, and what little silt may be found in the lower Charles, from street wash and the like, will be kept out of the harbor by the settling basin formed by building the dam.

"Mystic Lake, near the mouth of the Mystic River, is deeper than any part of Boston Harbor. That it has maintained this great depth is clear proof of the small amount of silt that has come from the river.

"The Board of Harbor and Land Commissioners, in their report of 1894, called attention to the apparent deepening of Boston Harbor between 1835 and 1861, and the apparent shoaling from 1861 to 1892, during which period the tidal reservoir was so greatly reduced by the filling in of the Back Bay (pp. xvii, xviii, Report of 1894)." Mr. Freeman concludes that these differences were mainly due to lack of precision in the surveys; and, curiously, it appears that the earliest survey — that under Loammi Baldwin in

1835 — was more accurate than those since made. To test this matter of shoaling, Mr. Freeman devised a method of boring through, sampling, and measuring the depth of the silt deposit.

That there has been no such shoaling as claimed is conclusively proved by borings made at places where this shoaling is supposed to have taken place; and the samples show the ancient mud, hereafter spoken of, at less than the average depth in Boston Harbor, overlying the old clays dating from the end of the glacial period,— and this notwithstanding that the tidal prism of the harbor above Governor's Island has been greatly diminished.

"Geological observations show that the accumulated silt or sandy mud, so universal on the bottom of Boston Harbor, is very ancient, covering in its growth climatic changes and changes in the level of Boston Harbor, shown by the presence of varieties of shells no longer living north of Cape Cod and the interstratification of this silt with peat in the surrounding territory. That the process of accumulation is very slow is shown by the estimate that it has taken five thousand years to gather together from two to five feet, and there has been no tendency to wash any of this out to sea by the action of the currents at the bottom."

Another most important theory in regard to the so-called seaward gain of the currents in the harbor has been exploded. While it is true that there is a seaward gain of the currents as measured near the surface (that is, that the velocity of the ebb-tide is greater than the velocity of the flood-tide), this is true only near the surface of the water; "but, measured from the bottom where the erosion takes place, the gain is not seaward, but landward. This seems to be explained by the fact that with a flood-tide the cold and heavier salt water dips under the warmer and brackish water, and keeps nearer the bottom."

The commission courteously recognizes "that it is due to the United States Commission of 1859 and '66 to say that at the time of their report physical data were very incomplete, the glacial theory had not been developed, and instruments of measurement were far less accurate than at present. It is not surprising, therefore, that this Commission [United States Commission of 1859 to

'66] reporting nearly forty years ago, should have been led into a wrong hypothesis as to the origin of Boston Harbor."

The commission has considered with care the commercial interests involved by the proposed changes, and has justly concluded that these may be preserved by the following means: the maintenance of sufficient space for the anchorage and manœuvring of vessels between the dam and the railroad freight bridge; the construction of a suitable lock in the dam; the deepening of the channel and canals; and the construction of suitable enbankments and retaining walls; and by making adequate provision for maintaining these canals free from ice during the winter months.

As a result of its studies, the commission recommends "that a dam be built on the site of the old Craigie Street Bridge, that it be built sufficiently high to keep out all tides, and that a fresh-water basin be maintained at a permanent level not below grade 8 or above grade 9." (These levels are referred to what is known as the "Boston Bench," 0.64 foot below mean low water.) This dam is to serve both as a dam and as a bridge, with a central roadway 100 feet in width, flanked by a marginal strip of 30 feet in width, on the up-stream side, for park purposes. The lock, which is to have a clear length of 350 feet, width of 45 feet, and a depth of 13 feet at mean low water, is to be crossed by a drawbridge giving a clear opening of 50 feet in width.

As conditions precedent to the construction of this dam, all sewage and factory waste is to be diverted from the Stony Brook channel and the Charles River between the Craigie Bridge and Waltham, and certain other contemplated changes in the sewage and storm-water disposal systems are to be made. Marginal conduits are to be built along the lower or down-stream portion of the basin; existing deposits of sludge and areas of shallow flowage are to be dredged; the banks of the basin are to be sloped and finished so as to leave no shallow pools, which might furnish breeding-places for mosquitoes; an embankment 300 feet wide in the rear of Brimmer Street and 100 feet wide in the rear of Beacon Street is to be built; and, finally, all salt water is to be excluded from the basin.

The commission proposes that the cost of the improvement of the basin proper be distributed as follows: seven-twelfths to the city of Boston, three-twelfths to the city of Cambridge, and one-twelfth each to the city of Newton and the town of Watertown. Recommendations are also made regarding the construction and maintenance of the work, and a draft of a legislative bill is submitted.

The estimated cost of the improvements, which appears in revised form in the introduction, furnishes interesting reading. The entire cost of the improvement is estimated at $2,957,350. Of this amount $435,000 will be required, even if the dam is not built: $378,000 is the estimated cost of work that has already been authorized for the embankment from Cambridge Street to the Fenway; $1,463,362 is estimated as the cost of replacing the old Craigie Bridge, which must be rebuilt in the near future; and $341,000 will be required to complete the construction of the wall between Cambridge Street and the Charlesgate East,— leaving a balance or total immediate increase in the expense, which will have to be met by the several municipalities on account of these improvements, of but $339,988. Moreover, these improvements will result in a future saving,— on the Metropolitan Park Commission work in the Charles River Reservation, $425,000; on the Cambridge esplanade, sea and beach walls, $99,000; and on the filling of the Cambridge marshes, $100,000,— or a total saving of $624,000. "These figures, it is true, do not include the cost of dredging the flats in the river to grade minus five, as has been suggested, which would entail a total expense of upwards of $1,000,000, but it is very improbable that such extensive dredging would ever be undertaken; nor do they include the future saving in the expense of constructing the sea wall between the Fens outlet and the Essex Street Bridge." Ignoring these facts and the interest charges upon the construction cost up to the time when these developments would otherwise have been required, it therefore appears "that the treatment of the basin with the dam will effect an estimated saving of $284,012 as compared with the expense of adapting the basin to public uses without a dam."

Such, in substance, is the report of the commission, which must be read and pondered to be appreciated. We have trodden upon the main highway of the investigation. The charming little byways and bridle-paths,— such as Freeman's study of the gradual subsidence of the harbor, foot by foot, from century to century; Professor Crosby's explanation of the gradual changes in the topography of the region during past geological times; Dr. Theobald Smith's inquiry into the pathological aspects of the situation; Dr. Field's research in the teeming biological life of the present basin; Mr. Clark's clever studies upon the chemical phases of the problem; Mr. Goodnough's valuable disclosures from the hidden records of the Massachusetts State Board of Health; the pages and pages of careful estimates and engineering plans and studies,— all these, to be appreciated, must be explored alone. Once found, the boldness of the view and the strong and rugged character of the surroundings cannot fail to hold the interest and stimulate further study.

Leonard Metcalf, '92.

A SUGGESTION FOR A SENATE AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

The President, and the other members of the Executive Committee of the Corporation of the Institute, together with those members of the Faculty of the School of Industrial Science of the Institute who are in charge of Departments of the School or who may be invited by the President to represent Departments not otherwise represented, and with the Secretary of the Faculty, shall constitute a body to be known as the Senate of the Institute.

The President of the Institute shall be the presiding officer of the Senate, and the Secretary of the Faculty shall be its clerk and shall keep its records and perform the usual functions of a secretary.

Meetings shall be held monthly, or at the discretion of the President or of a majority of the members of the Senate present and voting at any meeting. Meetings shall be held, as far as possible, at regular times; and notices shall be sent by the secretary, announcing, when practicable, the chief business of the meeting.

The meetings of the Senate shall be open to all members of the Corporation and of the Faculty of the Institute, and notices shall be regularly sent to them, except that members alone shall be invited to any meeting when request to that effect is made by the President or by any member of the Senate.

The Senate is to be a deliberative body, but not an executive or administrative one. It is not intended to assume any part of the duties or functions of either the

Corporation or the Faculty, or of any of their officers or committees. Its chief aim shall be to promote the welfare and development of the Institute in all possible ways consistent with the limitations just cited. As one of the means most effective to this end, the fullest possible discussion and interchange of ideas upon the current and prospective work of the Institute is to be the main business of its meetings. An address shall be made annually by the President, supplemented by such occasional addresses as he may, from time to time, desire to present to the Senate. Each head or representative of a Department shall present each year, at such times as may be determined by the Senate, a report upon the work of his Department during the preceding year, upon its present condition, and upon its plans for the future. The reports shall include statements of the work of all members of the staff of instruction of the Department in research, in publication, in the preparation or development of new courses or means of instruction, accounts of progress in undergraduate instruction, and a review of all graduate research carried out under the auspices of the Department. Effort shall be particularly directed, in the reports and in their discussion, toward such a delineation of the broad aims and central purposes of the Departments, and of their plans and possibilities for the future, of their needs and their opportunities for growth, as to insure that complete mutual comprehension of accomplishment and design which alone can insure the unity of action so essential and so difficult to the successful administration of an institution so highly specialized as is the Institute. The reports shall be addressed to the President and Senate of the Institute, and shall form a part of the records of the Senate.

Participation in the discussions of the meetings shall be

open to all members, and to all persons present by invitation; but the privilege of a vote shall be restricted to the members. The records of the meetings shall be open to all members of the Corporation and of the Faculty, but are otherwise subject to the disposal of the Senate only by a majority vote of members present and voting. In the case, however, of meetings to which members only have been invited, members of the Faculty who are not members of the Senate may be requested to forego the privilege of the records for such time as the Senate may specify.

The Senate shall be recognized as having the privilege to communicate its proceedings formally to the President, Executive Committee, or Corporation of the Institute, and to the Faculty, provided that such communications be consistent with the limitations of the function of the Senate, as above recited.

Silas W. Holman.

Brookline, Mass., Feb. 8, 1900.

EDITORIALS

The readers of the REVIEW will welcome the posthumous words, few though they be, which come to them in this number from that wise and devoted son of the Institute, Professor Holman. In the long agonizing years when he was so courageously awaiting in almost utter helplessness the inevitable end, he gave his clear mind to the consideration of many of the problems with which the Institute is unceasingly confronted. The very fact of his isolation made him see more plainly than could those in the hurry and confusion of their daily duties the real trend of the Institute's progress and the true avenues of its best development. So weighty was his judgment and so sane were his conclusions that it is much to be regretted that he did not commit to paper more of his thoughts and impressions. That he thought this suggestion for a Senate worth writing down gives it added weight and value. It certainly presents a new line of thought, and, possibly, a fruitful means for promoting the strength and usefulness of the Institute of Technology.

"Senates" of one kind and another have been tried in various colleges; but they have had mainly to do, we believe, with prudential questions. If the Institute in time adopts the dormitory system, such a senate, in which representatives of the administrative and teaching officers and of the student body shall have seats, may help towards the successful working of that system. The Senate suggested by Professor Holman, however, is of a different character, and attempts to provide for a possible danger due to the Institute's rapidly increasing size. The Corporation and the Faculty, each in its way, is striving with rare enthusiasm and devotion to promote the highest good of the Institute. In the early days, when numbers were few and courses of study were limited, it was easy not only for each body to know what the other was doing, but also for every

member to keep informed of the aims and aspirations of his colleagues. But in these days of sixteen hundred students, of labyrinthine courses, of many buildings, and of ever-new plans for growth and development, it is inevitable that the two bodies should drift somewhat apart, and that the only official means of communication between them, the President, should find it increasingly difficult to convey from one body to the other, and especially from one department to another, all the teeming thoughts, aims and plans under consideration. Such a scheme, therefore, as Professor Holman outlines is worthy of at least serious consideration, and the suggested Senate, carefully organized, might well prove of distinct benefit to the Corporation, to the Faculty and, consequently, to the Institute as a whole.

With the erection of the proposed "link" between the Rogers and the Walker Buildings,— a link which may connect but never, alas, can harmonize their clashing architecture,— the question of the right of the Institute to utilize the whole of its two-thirds of the square bounded by Boylston, Berkeley, Newbury and Clarendon Streets, may possibly be brought before the courts. For in the recent Act of the Massachusetts Legislature granting authority to the Institute to build over the entire area of its land between Boylston, Clarendon, Newbury, and Berkeley Streets, or to sell the same without encumbrance, or compensation to the State, a clause was inserted providing that the adjacent land-owners should have the right of legal redress for damages sustained by them in consequence of any act of the Institute committed under this legislative grant. This provision was inserted, we understand, in recognition of the plea of the abuttors that, in view of the fact that the State itself had originally prescribed the limitations under which the land should be used, the removal now of these limitations by the State, the supreme authority and original grantor, would deprive them — the abuttors — of the usual rights of suit and legal redress in cases involving restrictions other than those imposed by the State Legislature.

As there seems to be some confusion in the minds even of its friends as to the attitude of the Institute in the matter of last winter's legislation, it may be well to direct attention to two vital points. The first and most important point is a little word, "or," in the Act of the General Court through which the Institute came into being. In Section 3 of that Act of Incorporation * it is declared that the second square westerly from the Public Garden, between Newbury and Boylston Streets, should "be reserved from sale forever, and kept as an open space, *or* for the use of such educational institutions of science and art as are hereinafter provided for." To the authorities of the Institute, to the legislative committees before which the merits of the petition were argued, and to the Legislature of 1903 itself, this *or* seemed plainly to indicate an intention on the part of the State of making this a public park only in case the nascent Institute of Technology should prove itself impracticable or unworthy. There seemed every reason to fear that a scheme so comprehensive as that set forth by Professor Rogers might prove impossible of realization; and it was natural, therefore, that the General Court in granting a charter to the Institute should make provision for an alternative use of the land in the event of a collapse of President Rogers's plan. The Institute having proved itself, however, fitted beyond the wildest dreams of its promoters to endure, it follows that the proposed alternative use of the square becomes null and of no effect.

The second point of importance is that in building over the whole of its two-thirds' share of the "Boylston Street campus," or in selling it for commercial uses, the Institute does not in the least damage the property of the abuttors. On the contrary, in the opinion of many persons competent to pass upon questions of real estate, the conversion of the square from its present uses to those of commerce would very materially enhance the value of the surrounding property already increased by many times its original cost. The only exception, perhaps, would be in the case of the Central Church,

* See p. 166 of the April, 1903, issue of the REVIEW.

whose very beautiful building is of great value, and could not, of course, be converted into stores or offices. But as this church property, without the payment of taxes, has enjoyed the open space for forty years, it might properly take the attitude of Trinity Church which, when asked to join in the outcry against giving the title in this square to the Institute, declared that it would do nothing to hamper the proper growth of an institution which had done and is still doing so much for the good of young men, for the development of our national resources, and for the uplifting of mankind.

As to the other abuttors on the Institute's property, were they likely to hold their estates indefinitely for residential purposes, they might claim sentimental damages; but it is inevitable that those buildings which are still used for dwellings must follow the others in a rapid transformation into shops and offices. They can no more stem the tide of trade than could the residents of Winter Street, of Temple Place, or of "Colonnade Row." This being the case, the occupancy of the Institute's land by offices, by a great hotel, or by any other of those buildings for which land as valuable as this is used, would not only not diminish the present values, but, on the contrary, would greatly enhance them by pouring out upon the four streets in question the large and ever-increasing crowds who would resort to the stores, offices, or hotel covering the space now given up to non-commercial uses. Outlook upon a park is of no advantage to a row of shops: it is far better for them to be faced by other shops, since such a frontage practically doubles the size of the passing crowd. Such streets in Boston as Winter Summer, School, and Washington make it clear that the value of real estate is in direct proportion to the itinerant population. It is only when streets are crowded to the last inch with human feet that the intending purchaser of abutting property must plaster the land, as the phrase is, with one-hundred-dollar bills.

A NEW LABORATORY FOR ELECTRO-CHEMISTRY

The readers of the REVIEW will be interested to learn that a new laboratory devoted exclusively to electrochemistry will be opened at the beginning of the school year. This laboratory has been equipped to provide facilities for the professional work in the senior year of students electing the schedule of electrochemical studies offered as an independent option in Course VIII., and for graduate students desirous of taking up this line of work.

Instruction in electrochemistry has been given to students in Physics since 1894, but the recent rapid development of the industrial applications of the science determined the department several years ago to extend the work and to lay out a schedule of studies directed particularly to this end. This Course was officially announced by the Institute in the summer of 1900. Provision for somewhat similar work had already been made at the Polytechnikums at Zurich and Darmstadt, and more recently special electrochemical laboratories have been established at Karlsruhe, Aachen, Berlin, and Manchester (England). In this country, too, distinct courses in electrochemical engineering and electro-metallurgy are now offered at the University of Wisconsin and at Lehigh, respectively, while more or less specialized instruction in electrochemistry is offered at many of our more progressive technical schools and universities.

The Course as laid out at the Institute aims to give a student a thorough grounding in the principles underlying electrochemical problems in general, and so much of electrical engineering as will enable him to deal with the various power problems which are likely to arise in connection with the installation of electrochemical plants. To this end the Course provides for a thorough training in theoretical, analytical, and industrial chemistry, and in theoretical and applied electricity, these subjects forming the foundation for the professional work in electrochemistry, which extends

throughout the fourth year. Instruction in organic chemistry, mineralogy, assaying, and metallurgy, and in the elements of machines and engineering, is also given to as great an extent as practicable.

The work in electrochemistry proper consists of a thorough course of lectures on theoretical and applied electrochemistry, accompanied by extended laboratory work on electrochemical methods and measurements, and on technical processes carried out on a scale sufficiently large to give the student some just idea of the factors which determine their efficiency. To provide for this work, the new laboratory will be opened in October as a part of the Rogers Laboratory. It was not until this summer that the space vacated by the Electrical Engineering Laboratories made the equipment of this laboratory possible. The laboratory occupies the rooms formerly devoted to the Physico-chemical and Heat Measurements Laboratories in the basement of the Walker building, these laboratories being now removed to more commodious quarters. It is 95×30 feet, and is divided into two distinct parts, one being devoted to electrochemical measurements and analysis, and the other fitted up for technical work. In the former the students' desks are arranged in groups of four, and are very completely equipped for electrochemical investigations. In the centre of each group of desks is a large electrically heated and regulated porcelain-lined thermostat. Each desk is provided with a 2, 12½, 25 and 110 volt circuit, rheostat, stirrer, gas, water, and suction. Besides an equipment for analytical work, each student is given a complete set of electrochemical measuring apparatus, including a Weston ammeter and voltmeter with three scales, Lippmann electrometer, potential boxes, conductivity bridges, voltameters, etc. The whole class is thus able to work at the same time on subjects which are being concurrently discussed in the lectures, and thus, in conferences held weekly on the current work, to compare results of each other's experiences. The laboratory is also equipped with special arrangements for electrochemical analysis. Special rooms adjacent to the laboratory are equipped for measurements of electrical conductivity, dielectric constants, etc.

The laboratory of Applied Electrochemistry is equipped with a double current motor generator of 25 K. W. capacity, which furnishes 1,000 amperes at 25 volts or 2,000 amperes at 12½ volts. Other voltages may also be obtained by varying the field of the generator. The generator is designed for electrolytic processes requiring large currents, such as occur in the manufacture of aluminum and of alkali. A storage battery of large capacity is also provided for depositions requiring currents at low constant voltage.

For processes requiring intense heat, but not electrolysis,— for example, the manufacture of graphite, carborundum, carbides, etc.,— the laboratory is provided with power from a single phase alternator of 30 K. W. capacity, which, it is expected, will be still further increased another year. By means of a special transformer designed in the department this energy can be transferred from 160 volts to 10 volts in steps of 10 volts each. The transformer may thus be used to obtain any multiple of 10 volts desired. A complete set of alternating and direct current electrical measuring instruments will be available for determining the electrical energy expended in the various processes studied.

The inauguration of a schedule of studies of the character outlined has been already justified by the call for men to fill electrochemical positions and by the number of students who have elected the course. At present (October, 1903), seventeen students are registered in the three upper classes, of whom eight are in the graduating class, and two are graduates of other colleges.

The staff of the department has this year been strengthened for carrying out the new work by the return of Dr. Thompson, who with the writer made a tour of inspection of foreign electrochemical laboratories two years ago, and who has since been making a special study of electrochemistry at the Polytechnikum at Zurich.

H. M. Goodwin, '90.

SHIP MODELS

Through the kindness of Dr. Charles G. Weld there was added last year to the equipment of the Department of Naval Architecture a shop for giving instruction in making models of ships. This shop, which is in the Mechanical Laboratories on Garrison Street, is a room twenty feet wide and sixty feet long, with an annex ten feet wide and forty feet long, half of which serves as a room for varnishing models, and the other half as a stock-room. In the main shop are ten benches, each of which can accommodate two students. In this same room are a band saw and a planing machine for preparing stock, and a grinder for dressing tools. There is a proper equipment of hand tools for working on models, and there are conveniences for gluing up models. An experienced model maker has been employed to give instruction at convenient times. During term time the shop has been open and the instructor in charge certain days of the week, as was found advantageous; and the shop was kept open during the mid-year recess and for two weeks in June. Work in the shop is voluntary on the part of the students, who have shown an appreciation of the opportunities offered them. Instruction was given last year to about thirty students of the regular course and also to seven of the naval constructors who are studying at the Institute. During a visit to the Institute, Admiral Bowles, the chief constructor, took great interest in the work of the model shop, and offered assistance in carrying it on.

This brief statement of work accomplished may very well be accompanied by reasons for opening such a shop and encouraging students to work in it. To begin with a negation, it is not expected that a naval architect will make ship models even at the beginning of his career, nor is it important that he should be able to superintend the work of model makers. If he has time and opportunity, and especially if he works on yacht designing, he will be likely to feel the fascination of the work, and may cut his own models, even though it might be more economical to employ a model maker.

The principal, if not the sole, reason for establishing this model shop is to give the young designer a real knowledge of the forms of the ships he designs. He first draws the ship's lines to a convenient scale, and then takes those lines to the model shop, and cuts a model to those lines with all the defects that there may be in them. Some of the faults have been pointed out by the instructor in the drawing-room, some may have escaped the attention of the instructor. Even if the shop instructor recognizes faults in the lines, he does not change them, but waits for the model to reveal the faults. Afterwards, if desirable, the model may be altered, and the lines changed to correspond; in any case, ship's lines take on a new meaning to the student; thereafter he thinks of the form of the ship, when he looks at her lines, which become to him only a way of expressing and recording the form.

Every one who takes interest in the days when American clipper ships led in the race for sea-borne commerce knows that they were designed in the model. These models were made of boards, or *lifts*, that were held together by long through tenons. After the models were cut, the tenons could be driven out, and the lifts were used for drawing the water lines, which needed no fairing or adjusting. From the water lines a full-sized body plan was drawn, from which were made the moulds to aid in hewing the frames. The Department of Naval Architecture has a number of these old tenoned models which have been finished and mounted for exhibition as a record of the work of old days. It may not be known that the same method of designing in the model is largely used to-day by the builders of the multiple-masted schooners that carry coal along our Atlantic seaboard. It is commonly known that models of yachts are often made for the satisfaction of the owners, and that such models, properly finished in different-colored woods or painted and gilded, make effective ornaments. It may not be so familiar a fact that yacht designers have models made to aid in determining forms, or that some yacht designers have their own model-rooms and model makers.

Another use for ship models is found in the modern yards where large steel steamships are built; namely, for laying out the plating,

with its laps, butts, and stealers. Models made in our model shop will be used for this purpose, which is a well-recognized part of the work of ship's draughtsmen.

It is expected that students of naval architecture at the Institute will hereafter make two models,— one of a yacht or other sailing vessel and one of a steamer. It may not be out of place to give briefly the drawing-room work which produces the lines which are used in making these models. To begin with, each student first lays down the lines of a steamer from a table of dimensions that is substantially correct, and thus learns how to draw and fair ship's lines. Then he undertakes the design of a yacht or other sailing vessel with lines that are essentially different and where attention is given mainly to form; this work takes about half a year. Afterwards he works for a year and a half on the design of a steamship for a particular service, getting out plans and specifications and calculating nautical properties. It is of the last two, the real work of the student himself, that models are made.

C. H. Peabody, '77.

LOWELL INSTITUTE SCHOOL FOR INDUSTRIAL FOREMEN

During the coming season a change will be made in the work done by the Lowell Institute in connection with the Institute of Technology. For more than a third of a century, Lowell Free Courses for advanced students have been given by the professors of the Institute of Technology. These courses have, in the past, done and are still doing no small amount of good; but, with the increased educational facilities of all kinds in Boston, these courses would seem to be less necessary than they were formerly. They have, moreover, covered many subjects without much relation to one another, and at the present day we are learning the great advantage of systematic study.

On the other hand, among the different classes in our community, there would appear to be one which has hardly received yet the attention which it deserves. We have heard a great deal of late years of captains of industry; but the efficiency of the industrial art depends, in a very large measure, and probably to a constantly increasing extent, upon the capacity of its non-commissioned officers, — in other words, upon the foremen. These men receive the same education to-day as the ordinary mechanic, and it has been thought that it would be a great benefit to the community at large if they could have some instruction in the principles of applied science, so that they might more readily understand the work they are superintending, and be ready to apply improvements in machinery. It is felt, also, that a better educated class of foremen would be a benefit to the community socially, as an intermediary class between the employer or engineer, on the one hand, and the workmen, on the other. To attempt, however, to train young men separately for the position of foreman would be, under the existing organization of labor, an impossibility. The foreman must continue for the present, at least, to be promoted from among the workmen. In giving them such an education as is desired, therefore, it is neces-

sary to take men who are already working at their trade; and hence instruction can be given to them only in the evening.

With this object it has been decided to substitute for the advanced courses hitherto given by the Lowell Institute under the auspices of the Institute of Technology an evening "School for Industrial Foremen," to comprise, at the outset, two courses, one mechanical and the other electrical, and each extending over two years. An outline of the courses is as follows: —

The subjects in the first year for both courses will be Practical Mathematics; Elementary Physics and Electricity; Elements of Mechanism and Gearing; and Drawing. The subjects taught in the second year Mechanical course will be Mechanics; Valve-gears; Elements of Thermodynamics, the Steam Engine and Boilers; Elementary Hydraulics; Testing Laboratory; Steam and Hydraulic Laboratory; and Mechanism Design and Elementary Machine Design. The second year Electrical course will include Valve-gears; Elements of Thermodynamics, the Steam Engine and Boilers; Steam Laboratory; Direct Current Machinery; Alternating Currents; Electric Distribution; Electrical Testing; and Dynamo Laboratory.

These courses include the study of those things with which the men are not likely to familiarize themselves in practice, and which will give them a fundamental training in principles that practical experience cannot supply. The aim has been to adapt the courses to the needs of the men and to make the instruction as thorough and as practical as possible, giving the men training along those lines which will be of the most service to them in the work in which they are engaged. Those who complete satisfactorily the required courses and pass the examinations will be given certificates at the end of the second year, and it is believed that these men will be found far better qualified to fill higher positions than they were before.

The first session will open in October, 1903, and continue through April. The instruction will be given by recitations, lectures, drawing-room practice, and laboratory exercises; and it will be given in the Massachusetts Institute of Technology by members of its instructing staff.

These courses are intended for those who are already following industrial pursuits; but, as the amount of ground to be covered is large, attendance from 7.30 to 9.30 for three or four evenings a week will be required, and no man who cannot also devote considerable time to study away from the school can do the work satisfactorily.

To be admitted, the applicant must be at least eighteen years of age, and he must have a good knowledge of arithmetic, including the metric system, elementary algebra, plane geometry, and mechanical drawing. It is intended in subsequent years to make entrance depend upon examination; but, as there would hardly be time for the necessary preparation before the school opens, it has been decided to admit applicants in this first experimental year mainly on the recommendation of their employers.

Like all courses conducted by the Lowell Institute, the instruction is, of course, free.

CHAS. F. PARK, '92.

GENERAL INSTITUTE NEWS

CORPORATION NOTES

The two hundred and ninety-eighth meeting of the Corporation was held at the Institute, Wednesday, October 14. Appointments by the Executive Committee were confirmed, as follows: David A. Allee, as Assistant in Civil Engineering; John Wardwell Howard, S.B., as Assistant in Civil Engineering; Walter Holbrook Adams, S.B., as Assistant in Mechanical Engineering; Edward James Ruxton, S.B., as Assistant in Mechanical Engineering; George M. Macdonald, B.Sc., S.B., as Assistant in Mechanical Engineering; Henry Hammett Fales, S.B., as Assistant in Mechanical Engineering; George Wright Swett, S.B., as Assistant in Mechanical Engineering; John Trott Alden, S.B., as Assistant in Mechanical Engineering; Theodore Howard Taft, S.B., as Assistant in Mechanical Engineering; Durward Copeland, S.B., as Assistant in Mining Engineering and Metallurgy; Carlton Francis Green, S.B., as Assistant in Mining Engineering and Metallurgy; Harry Raymond Low, S.B., as Assistant in Mining Engineering and Metallurgy; Leslie Rogers Moore, S.B., as Instructor in Inorganic Chemistry; Arthur Alphonzo Blanchard, S.B., as Instructor in Inorganic Chemistry; Livingston W. Smith as Instructor in Inorganic Chemistry; John Ripley Odell, S.B., as Assistant in Analytical Chemistry; John W. J. Calnan, S.B., as Assistant in Inorganic Chemistry; Richard B. Earle, Ph.D., as Assistant in Organic Chemistry; Harold Osborn, S.B., as Assistant in Electrical Testing; Robinson Pierce, Jr., as Assistant in Physics; Frank Baldwin Jewett, Ph.D., as Instructor in Physics; William Otis Sawtelle, S.B., as Instructor in Physics; Henry Waldeck Buhler, S.B., as Assistant in Heat Measurements; Eugene D. Forbes, S.B., as Assistant in Physics; William Henry Whitcomb, S.B., as Assistant in Physics; Percy Goldthwaite Stiles, Ph.D., as Instructor in Physiology and Personal Hygiene; Gerald Francis Loughlin, S.B., as Assistant in

Geology; Harold Arthur Everett, S.B., as Assistant in Naval Architecture; Wilfred E. MacDonald, as Instructor in Mathematics; Burton H. Camp, as Instructor in Mathematics; Charles H. L. Johnston, A.B., as Assistant in English; Frank A. Brown, as Assistant in Forging; Eugene Stillman Foljambe, S.B., as Instructor in Mechanical and Descriptive Geometry; James Russell Putnam, S.B., as Instructor in Mechanical Drawing and Descriptive Geometry; John A. French, Jr., as Assistant in Mechanical Drawing; Winfield C. Towne, as Instructor in Gymnastics; Claude S. Hudson, S.M., as Research Assistant of Physical Chemistry. Change of title: James F. Leary from Assistant in Forging to Assistant in Machine Tool Work.

The opening of the year has passed in all respects fortunately. The entering class has suffered some reduction, as was anticipated, in consequence of the simultaneous advance of the tuition fee and the requirements for admission. The number of applicants from other colleges, however, is large and notable in quality, including representatives of the following colleges and universities: Acadia, Amherst, Armour, Beloit, Boston (University), Bowdoin, Bucknell, Civil Engineering (India), Colby, Colorado, Agricultural, Franklin and Marshall, Georgetown, Hamilton, Harvard, Holy Cross, Indiana, Iowa, Johns Hopkins, Kansas, Louisiana, Malta, Middlebury, Minnesota, Mercer, Missouri, North Carolina, North Texas Normal, Norwich, Oberlin, Ohio State, Ouachita, Pennsylvania, Princeton, Rochester, Rock Hill, Stevens Polytechnic, Swarthmore, Southwestern Baptist, Syracuse, Technical High School (Munich), Tufts, Texas, United States Naval Academy, Washington, Wesleyan, Wisconsin, Worcester Polytechnic, Yale, and Yankton.

Foreign countries represented among the entering students are England, Ireland, Germany, India, and the Island of Malta.

The number of naval cadets sent to the Institute at the beginning of last year was four instead of three, and afterwards five others were sent at different times on account of the government's urgent need for men. These five have been enabled, by special arrangements, to complete the essential part of the year's work, making

a class of nine. In consequence of this, however, there have been no more cadets sent the present year.

FACULTY NOTES

The Faculty has lost by resignation Professors Faunce, Hough, and Locke. New appointees include Assistant Professors C. L. Adams in Drawing, H. W. Gardner in Architecture, F. P. McKibben, and C. M. Spofford in Civil Engineering, S. C. Prescott in Biology.

Professors Cross, Despradelle, Hofman, Noyes, Walker, Goodwin, Whitney, Fay, and Moore have spent more or less of the summer vacation in Europe; while Professors Bartlett and Bardwell are making a more prolonged stay for advanced study. Professor Richards has made an extended Western tour, meeting Institute men at many points.

The Fifth International Congress of Applied Chemistry, which met in Berlin during the first week in June, was attended by a large representation from the Chemical Department, consisting of Professors A. A. Noyes, W. H. Walker, W. R. Whitney, and Henry Fay, of Doctors P. S. Burns and M. S. Sherrill, and of Mr. R. W. Balcom, '00, G. V. Sammet, '01, and A. P. Hall, '02. The total registration at the Congress was about 2,600. There has probably never before been an occasion where so many chemists, and especially where so many of eminence, were gathered together: the attendance was by no means confined to industrial chemists, as the name of the Congress might seem to imply; but many of the leaders in pure chemical and physico-chemical research were present, among whom van't Hoff, Moissan, Ramsay, Crookes, Kohlrausch, Nernst, and Arrhenius may be mentioned.

The meetings were conducted on the same general plan as those of the American Association for the Advancement of Science. The Congress opened and closed with general sessions held in the Imperial Parliament buildings, at which general business was done and addresses of common interest were presented, while during the remainder of the week the Congress resolved itself into eleven

different Sections, which devoted themselves to the consideration of papers and reports relating to special departments of industrial chemistry. The Section of Electrochemistry and Physical Chemistry was especially well attended and well provided with contributions, thus illustrating the industrial significance of this branch of scientific research. Speakers at any of the meetings used German, English, or French, according to their nationality; and at the general sessions business announcements were made in succession in these three languages.

The social entertainments connected with the Congress were numerous and elaborate. These consisted of a banquet attended by two thousand members; a Kommers, in true German style, of equal magnitude; a specially arranged performance at the opera; a Sunday excursion to the Wannsee, a chain of beautiful lakes in the neighborhood of Berlin; and many private receptions at which good opportunity for making acquaintances was afforded.

The next meeting of the Congress is to be held in Rome in 1906.

The American Mathematical Society held its summer meeting at the Institute, August 31 to September 5, with a relatively good attendance. The society meetings proper ended September 1, but the four days following were occupied by a Colloquium. The lecturers were Professor E. B. Van Vleck, of Wesleyan University, Professor H. S. White, of Northwestern University, and Professor Woods, of the Institute,— a fact of interest being that all three were students at Wesleyan at the same time. Professor Woods's subject was "The Connectivity of Non-Euclidian." The lectures were attended by nearly thirty persons. The society was entertained by Professor and Mrs. Pickering, in a delightful reception at the Harvard College Observatory; and excursions were made to numerous points of interests.

Professor Sedgwick has been recently engaged at Chicago in connection with the great controversy in regard to drainage canals.

DEPARTMENT NOTES

MECHANICAL ENGINEERING

Changes in the instructing staff are as follows: Messrs. G. Lloyd Wayne, Walter H. James, and Lawrence S. Smith have been promoted to the grade of instructor. Assistants Harry R. White and Clarence D. Starr, having resigned, Messrs. John T. Alden, '97, and Theodore H. Taft, '02, have been appointed assistants.

In consequence of the large number of students, five additional assistants were needed; and the following have been appointed, namely: Walter H. Adams, Henry H. Fales, George M. Macdonald, Edward J. Ruxton, and George W. Swett, all of '03.

A treatise on Graphical Statics by Professor Sondericker has been published (John Wiley & Sons, publishers).

Series of tests were made last year under Professor Lanza's direction, by Messrs. W. H. Adams and J. F. Atwood, upon re-enforced concrete beams, having sections 8 inches by 12 inches and spans 11 feet; and by Messrs. G. M. Harris and G. B. Wood, upon re-enforced concrete columns, having sections 8 inches by 8 inches and 10 inches by 10 inches, and lengths of 6, of 12, and of 17 feet. The results obtained thus far have been published by Professor Lanza in the Transactions of the American Society of Civil Engineers, vol. 50, year 1903, p. 483 *et seq.*

During the last year a 40-hour duty test was made at the Lincoln Wharf Power Station of the Boston Elevated Road, under the direction of Professor Miller, by the fourth-year students of Courses II., VI., X., and XIII., the horse-power exerted during the test being, on an average, 3,700.

The following plant tests were made as thesis work by different students, under Professor Miller's direction: —

1. A 24-hour test of a 10,000,000 gallon pumping engine at New Bedford.

2. A 24-hour duty test of the new high-duty pumping engine at Brookline.

3. A series of tests of a 4,000 H. P. Westinghouse Parsons turbine at Hartford, Conn.

4. A series of tests of a 150 H. P. De Laval turbine plant at Everett.

MINING ENGINEERING

Students of the mining course in the class of 1903 have been retained in the department; namely, Messrs. Low, Green, Copeland, and Buhler for the department, Messrs. Knight and Yerxa as private assistants to Professors Richards and Hofman.

The apparatus for the microscopic study of metals, called metallography, has been doubled so as to provide for the large classes.

Professor Richards has made a long trip during the summer, visiting Western mines and mills to bring up the quality of the instruction in those subjects. He has brought back a great amount of new facts and new data, which will be placed at the disposal of the students as opportunity occurs.

Mr. A. R. Wilfley, of Denver, has presented the laboratory with a new Wilfley slimer, to be used by the students in treating the finest slimes, for the recovery of their metallic contents by the mechanical or ore-dressing method. He has also presented a standard Wilfley mechanism which is to be adapted to a little Wilfley table to be constructed here.

A new revolving screen has been added to the little mill plant. The work to be done by this machine has in the past been done before the class came into the laboratory. It is now thought that by putting in this connecting link and having the students do this work the mill will be made much more instructive and complete.

Professor and Mrs. Robert H. Richards have just returned after a delightful vacation trip out West, including the Yellowstone Park and Alaska. Mr. Richards went especially to investigate the concentrating mills of the mining districts, while Mrs. Richards visited many of the universities west of the Mississippi River, and made a preliminary examination of the waters of the Black Hills and of Alaska. Incidentally, Institute men were looked up and meetings suggested. Professor Richards finds that a decided advance has been made in the art of milling since his last visit in 1895. The invention of the Wilfley table has put a very efficient machine for treat-

ment of moderately fine material in the hands of the mill men. The losses of values in the extremely fine floating grains have been located, and, in some cases, efficient measures for saving these values have been installed. The mills are worked on a larger scale, and in consequence lower grade ores will now pay to work. Mrs. Richards took this occasion to extend her acquaintance with schools and colleges, especially the State universities. It is difficult for an Eastern person to realize, even by intelligent reading, the extent to which the States of Montana, Idaho, Washington, Nevada, Utah, and Colorado, have supported the crowning edifice of their public school systems. The amounts of money recently appropriated seem to be utilized to the best advantage, and the method of equipping one department at a time with the most approved apparatus will in a very few years give complete and excellent plants. The University of California is deservedly well known in the East. In all these schools new facilities for the teaching of mining engineering have been or are being provided. Through the courtesy of the University of California, Mrs. Richards was enabled to finish the analysis of the samples of potable water collected in Alaska. An interesting survey of the waters of the Black Hills of South Dakota was also made. Mrs. Richards reports a very great advance in the abolition of wells and the installing of reliable water supplies for mining towns: —

In one place only did we find a hotel preferring the well full of town seepage to the town supply drawn from a fresh mountain stream. Our meetings with Tech men were many, varied, and very pleasant. Weeks, '71, chief engineer of the Burlington route in Nebraska, invited us into his private car during his tour of inspection of bridges. In this way we went through the Spearfish cañon, and visited the beautiful Sylvan Lake. Moody, '90, introduced us to the great Homestake property and to Ruby Basin. Baxter, '01, showed us the Hidden Fortune mill,— all of which are in or near Deadwood, So. Dak. At Butte, Goodale, '75, gave us an evening entertainment, at which were Adams, '87, Craven, '98, and Burr, '02, At Anaconda we were entertained by Demond, '93. At Great Falls, Goodale again entertained us; and here we met Hutchinson, '98, Roberts, '00, Wheeler, '94, and Draper, '98, Craven, '03, and one other whose

name we do not recall. At Kellogg, Idaho, we spent the night with Wiard, '99. At Spokane we spent two days with Sonnemann, '90. At Seattle, Mr. Richards was given a dinner by Dabney, '75, Noble, '86, Lukes, '92, Bleecker, '98, Allen, '00, Clary, '00, Frink, '00, Walker, '00, Harris, '01, Sturtevant, '01, Batcheller, '00, Wheeler, '95, and Backus (?). We were also entertained at the house of Clary, '00. At Portland, Ore., we were entertained by Batchelder, '79, and Reed, '94. In San Francisco, Mr. Richards was given a dinner by Willcutt, '83, Henck, '76, Adams, '78, Plummer, '00, Harvey, '93, Bugbee, '00, Hersam, '91, Leland, '91, Bliss, '95, Fish, '95, Libbey, '95, Bowey, '96, Godbole, '98, Bennink, '99, Tweedy, '00, Howard, '85; and he was further entertained by Hersam, '91, with other friends at the University of California, and by Plummer, '00, with friends at Placerville. We were entertained for a fortnight by Harvey, '93, at Galt. At Grass Valley we were entertained by the family of Foote, '99, Foote being absent in Korea. At Salt Lake City we met Cannon, '99, and at Mercur, Moore, '98, who entertained us. At Denver we were entertained by Brace, '87, and met Bunce, '84. We entertained Low, '76, Locke, '72, and Brace, '87. At all of these meetings we talked over the good old times at Tech, and the fine record our Alma Mater has made, which is held to be second to none of her years. To the reader it may seem that we were the recipients of all the favors, and returned none. Such was the fact: all effort on our part to make returns was met with negatives. The kindness, good will, and good fellowship of former Tech students is unbounded. We were the recipients of it because we at the moment represented Tech; and, in returning thanks for it, we again represent Tech, as we believe Tech is as thankful as we.

ARCHITECTURE

In the Department of Architecture, the unusually large entry of students has necessitated the appointment of another instructor in design. It has been the good fortune of the department to find one of its former pupils admirably fitted for the position, Mr. Allen H. Cox; and he will devote the afternoons to its demands.

Mr. Cox is a practising architect of the firm of Putnam & Cox, of this city, whose success in winning the recent Athenæum competition is well known. He had had some years' office experience before coming to Technology, which allowed him to enter the

second year course in 1896, as a special student. He completed the professional work of the entire course, including the graduate year, in 1899, and immediately thereafter went abroad. The next two and a half years were spent in study and travel. Some time was passed in England measuring and studying many of the well-known landed estates in the interest of landscape architecture, and more was spent in Paris at the Beaux-Arts.

In the spring of 1902 Mr. Putnam, his present partner, invited him to enter the Athenæum competition with him; and he returned to Boston for that purpose. After winning this prize, the partnership was formed; and Mr. Cox returned to Paris, to the École, in order to devote himself to a year's further study to prepare himself as well as he knew how to carry out the design which had won for the firm such honor. After four months, however, business called him home; and since then he has been in the active practice of his profession.

Mr. Cox will not be assigned the instruction of a particular year, but his services will be put to use where at the time they will be most needed. His position will be somewhat like that of the "Ancien" at the École des Beaux-Arts, the old skilled student who helps the younger men over their difficulties as they appear. Mr. Cox brings, with his fine preparation, such enthusiasm for his profession, and devotion to it, that the department is greatly to be congratulated on this addition to its corp of instructors.

PHYSICS

In the Department of Physics, Dr. Goodwin has been appointed Associate Professor of Physics and Electrochemistry. After two years of study at the Polytechnikum at Zurich, Mr. M. DeK. Thompson, instructor in electrochemistry, has returned, having taken the degree of Ph.D. with high honors. Mr. R. R. Lawrence discontinues his work in second-year physics recitations. Messrs. Clifford M. Swan, Frank B. Jewett, and William O. Sawtelle have been appointed instructors in physics, giving part of their time to instruction in the physical laboratory and part to class-room work.

Mr. Swan graduated at the Institute in 1899 in chemistry, and continued his studies there subsequently to his graduation. He was appointed assistant in physics in 1902. Mr. Jewett graduated at the Throop Polytechnic Institute, and later in 1902 received the degree of Ph.D. at the University of Chicago. He was research assistant to Professor Michelson and an instructor in the university for two years. He will take charge of some of the instruction in theoretical electricity and other subjects hitherto given by Professor Clifford, including optics and the propagation of electric waves. Mr. Sawtelle graduated from Course VIII. at the Institute in 1898, and has since been in charge of the mathematical instruction in the Bangor High School.

Assistants have been appointed as follows: Robinson Pierce, Jr., Ph.B. at Brown University, Fellow in Astronomy and M.S. at Princeton, 1903; Eugene D. Forbes, S.B., M. I. T. 1903; James M. Gammons, S.B., M. I. T. 1903; William H. Whitcomb, S. B., M. I. T. 1903; in physics; and Henry W. Buhler, S.B., M. I. T. 1903.

An important change has been made in the instruction in second-year physics. The class for several years has been unwieldy in size; and the lecture room, though enlarged as greatly as was practicable, has been excessively uncomfortable. Moreover, it has long been the opinion of Professor Cross that not more than 400 students at the outside could profitably be cared for in a single section, with lectures of the character of those given. With the large class which entered a year ago, it was seen that the second-year class would have to be divided; and this has accordingly been done. Lectures are given on Monday, Wednesday, and Friday by Professor Cross, and on Tuesday, Thursday, and Saturday by Professor Wendell. Professor Wendell gives up most of the sections in recitations to the newly appointed instructors. No. 22 Walker has been restored to its original size, seating about 250 persons, while No. 23, also occupied by the Physical Department, accommodates about 200.

The increased force of instructors and assistants and the increased lecture-room space placed at the disposal of the department

have made it possible to give the lectures in physics at an earlier hour than heretofore; that is, from 11 to 12 instead of from 12 to 1, the latter hour having been devoted to the physics lectures almost from the beginning of the Institute. This is a change which will be greatly welcomed by all students. The reasons which originally led to the selection of the latter hour ceased to exist a good while ago, but the change has hitherto been impracticable.

MATHEMATICS

In the Mathematical Department Professors Bartlett and Skinner have been given leave of absence for a year, and Dr. Haskins has accepted an instructorship at Yale University. Professor Bartlett is engaged in mathematical study and visits in Germany, spending the greater part of the winter at Munich. Of the new appointees, Dr. Mason is a graduate of the University of Wisconsin, and has just returned from study at the University of Göttingen, where he has taken his degree. Mr. Camp is a graduate of Wesleyan University at Middletown in 1901, and has since spent a year in advanced work at Harvard. Mr. McDonald is a graduate of the University of Tennessee, and has been for two years at Johns Hopkins University.

ELECTRICAL ENGINEERING

The Augustus Lowell Laboratories of Electrical Engineering are fast taking on their permanent arrangement, and by the latter part of the first term will afford ample opportunities for the instruction of the large number of students who will then enter the laboratories. In addition to the regular undergraduate work of the students in Electrical Engineering, the laboratory must accommodate this year a number of graduate students, the naval cadets, and certain students in the Departments of Mechanical and of Mining Engineering. With the importance which electrical subjects are assuming in all branches of engineering, the resources of the laboratory promise to become more and more taxed in succeeding years.

In the Graduate School of Engineering Research, application has been filed by Professor Harold B. Smith, head of the Electrical Engineering Department at the Worcester Polytechnic Institute, who comes here with the intention of studying for the degree of Doctor of Engineering.

In the Laboratory of Electrical Testing, Mr. Harold Osborn, a graduate in Electrical Engineering in 1903, has been appointed assistant to replace Mr. Dart, who has entered into engineering practice. Mr. Montague Ferry, a graduate of the Sheffield Scientific School of Yale University, and later a graduate in Electrical Engineering at the Institute, has been appointed assistant in Electrical Engineering.

The new radial photometer, designed by Mr. Lawrence of the department for photometric measurements on lights of high candle power, is set up in one of the photometer rooms, and will be used both for undergraduate and thesis work. Investigations are in progress in the line of photometric work on the errors due to the neglect of the Purkinje effect in technical photometry, and also a study of the Nernst lamp as a secondary standard.

The Journal meetings, which were begun last year, will be continued, and a system of laboratory conferences, in which the work in the Dynamo Electric Laboratory is discussed with special reference to its bearing on engineering practice, has been inaugurated. There has been a considerable addition to the lecture-room models of the department used for the instruction in direct and alternating current machinery. The amount of time devoted to Theoretical Electricity has been much increased, and it is the intention to have this work and that in the laboratories much more closely related than heretofore.

The department has received from the National Electric Company a gift of a Standard Air Brake Equipment, which will be extremely useful for purposes of laboratory instruction in connection with the work in electric railways. The Westinghouse Electric and Manufacturing Company has given to the department a Walker Permeameter.

As subjects for investigation, either proposed or already under

way, are : a Study of the Scott Transformer System, the Inductance and Resistance of Steel Rails, the Hunting of Various Types of Alternating Current Machinery, Electrometer Methods of Measuring Power on High Voltage Circuits, Dielectric Hysteresis, Transformer Methods for Alternating Current Measurements in General, and the Cooper-Hewitt Rectifier.

BIOLOGY

Professor Theodore Hough, for ten years connected with the Biological Department of the Institute and since 1895 Assistant Professor of Physiology, has been appointed Associate Professor in charge of the Department of Biology in Simmons College, and left the Institute this fall to take up his new work. The instruction in physiology and personal hygiene will hereafter be in charge of Dr. P. G. Stiles, a graduate of Course VII. in the class of '97, Ph.D., from Johns Hopkins University, 1902, and more recently Instructor in Physiology at the University and Bellevue Hospital Medical College of New York University. Dr. Stiles will give a brief course in plant physiology in addition to the work as outlined in the Catalogue. The only other changes in the work of the department will consist in the offering of a new course during the second term, to be called "The Public Health Seminar," in which senior and graduate students in Sanitary Engineering will be given an opportunity for study of special problems in water supply, sewage disposal, and other branches of Municipal Sanitation. Room 23 has been fitted up as a new research laboratory for the Biological Department, and affords better facilities than have ever been available before. The Laboratory of Comparative Anatomy has been transferred from Room 23 to Room 25.

ENGLISH

The work of the English Department is from year to year being extended so as to take in the largest amount possible of co-operative work in connection with the technical studies of other departments. Papers written in connection with the special courses are

examined for technical errors by instructors in the several branches, and are then sent to the English instructors for criticism on points of composition and expression. In this way translations are taken from all the classes in foreign languages; and from the Civil, Mining, and Electrical Engineers come memoirs or essays of various sorts. From the Architectural Department come papers on ancient buildings, and from Course VIII. reports of colloquiums. A step of the greatest importance was taken last year in extending the First Year English through the second term, and this with the power to condition at any time a student who shows himself unreasonably deficient gives the department an excellent chance. The department has lost Mr. Valentine, but his place has been filled by the appointment of Mr. C. H. L. Johnston (Harvard, '99), who has had some experience in teaching and has already published some good literary work.

ECONOMICS

Mr. C. W. Doten has been appointed instructor in economics. Mr. Doten fitted for college at Troy Conference Academy, Poultney, Vt. Graduated from the University of Vermont with the degree of Ph.B. in 1895. Took special honors in philosophy, and was commencement speaker and member of Phi Beta Kappa. He also received the degree of A.M. from the University of Vermont in 1899 and from Harvard in 1902. He was instructor in elocution at the University of Vermont during 1895, secretary and registrar during 1896, and had charge of English theme work during 1897–98.

DRAWING

In the Department of First Year Drawing have been appointed two new instructors: Eugene S. Foljambe, S.B., is a graduate of the Department of Naval Architecture, M. I. T. '01. Mr. Foljambe has had several years' experience in teaching drawing in the public schools of Denver, Col., and was assistant in machine tool work in the Mechanical Laboratories of the Institute 1901–02, 1902–03.

James R. Putnam, S.B., is a graduate of the Department of Mechanical Engineering, M. I. T. '01. He has been employed as

draughtsman for the American Soda Fountain Company, and the Cycloidal Engine Company since his graduation.

John A. French, Jr., has been appointed assistant in mechanical drawing. He has been employed for seven years as a draughtsman with the following companies: International Paper Company, Rumford Falls; Portland & Rumford Falls Railway Company; and the B. F. Sturtevant Blower Company, Jamaica Plain.

GYMNASTICS

Winfield C. Towne, A.B., has been appointed Instructor in Gymnastics in place of Mr. Skarstrom, resigned. Mr. Towne is a graduate of the Biddeford High School. Entered Bowdoin College in the fall of 1899, and, along with his regular college course, became a student of gymnastics. Made his various class football and track teams, also the 'varsity football and the Worcester track teams. He was a member of the dumb-bell, broad-sword and fencing squads, being leader of the latter. Was made an assistant in the Sargent Gymnasium during Sophomore year. During his last two years he was assistant to Dr. F. M. Whittier, A.M. (Director of the Sargent Gymnasium, Lecturer on Hygiene, and Professor of Bacteriology and Pathological Histology in the Bowdoin Medical School). During this time he was assistant instructor of the gymnasium, having entire charge of the Freshman classes.

Mr. Towne believes that the object of gymnastics in our schools should be both hygienic and educational; and, in making out his plans for work with the students, he has considered this very carefully. His idea is that gymnastics, to be developing, should be systematic, and that there should be progression from the easy and simple to that which is harder and more complex, both from exercise to exercise in one lesson, and from the order of one lesson to that of another.

In the course in gymnastics, which will begin, as usual, about November 9, he will in general adopt the following day's order, though he may change it according to conditions. He will preface

each day's work by order movements, which will consist of taking the fundamental positions, alignments, marching and evolutions from military tactics, which will require only a minimum of exertion. Following this, he will devote a few minutes to free exercises, intended to increase the low respiration and circulation and relieve the brain from the congestive tendency created by a prolonged mental strain. These introductory movements will consist of head, arm, trunk, and leg movements, among which the latter will be most emphasized. In the next exercise he will increase the muscular resistance, and continue calisthenics by giving dumb-bell exercises. This will doubtless be changed to single-stick exercises during the winter term. Although Mr. Towne thinks that free exercises are of great importance in a gymnasium as introductory movements, he does not think that they noticeably increase the size of the muscles or bring great strength, but rather add to the symmetry of the body. So he thinks it advisable to use dumb-bells, clubs, or single sticks, for advanced classes, for the special development of the arms and shoulders. Next will come heavy gymnastics or exercises on the apparatus, which will consist, in general, of hanging and supporting exercises, alternating with vaulting and jumping. For these exercises he will divide the class into small squads, each under the supervision of a leader, who will show certain exercises, supervise them, and assist, when necessary. When the squads have practised one kind of exercise for a certain time, there will be a general change of squads to a different apparatus, and so on until each squad has gone through with the required number of exercises. Then he will close the lesson by leg movements, such as running, or some kind of gymnastic games.

SUMMER SCHOOL IN ARCHITECTURE

For the third time since the Summer School was made a feature of the Department of Architecture, the school has been held in Europe. On the two previous occasions, under the direction of Professor Homer, it was limited to about two months' duration and to the study of certain periods of architecture. Thi

past summer the entire four months' vacation was devoted to the school, and its object was a study of architecture in general. It was open this year not only to the fourth-year students, but also to the younger classes; and for greater convenience in travelling and to afford more individual instruction the number of students was limited to five.

Made up of two men from both the second and third year and one senior, the school left New York on June 2. We landed at Naples two weeks later after one of those interesting and enjoyable voyages which can only be had in crossing by the southern route and at that time of year. A few days were spent at Naples, which has a more human than architectural interest; and we began our study of architecture with a trip to Pompeii and the Greek temples at Pæstum. Perhaps the most enjoyable, if not the most instructive, part of this excursion was our two days' carriage ride along the coast, in returning to Naples by way of Salerno, Amalfi, and Sorrento,— two days of fine weather, beautiful and picturesque scenery, and in a part of Italy comparatively little visited by tourists.

Rome was the next city to be visited in our journey north. Here and in all the large cities from ten to fourteen days were spent in visiting the buildings which until now the students had known only from photographs. The fatigue of continuous sight-seeing was relieved by sketching. The hot weather limited somewhat our time for this; but, on the other hand, we were favored by a scarcity of rain, having but two days of showers in our two months' stay in Italy.

From Rome we went to Florence by way of Perugia, and from there to Venice, visiting on the way for a day or two the smaller towns of Siena, Pisa, Pistoia, Bologna, and Ferrara. We approached Venice by water from the small fishing village of Chioggia. This is a much more attractive way than by train, and well worth while; for one's first impression of this city has much to do with the after-enjoyment of its charm and beauty. Here we found relief from the intense heat of the inland towns and plenty of interest to see and sketch during our stay.

By this time there was a desire to get to Paris, the home of the

École des Beaux-Arts, and the fountain-head, so to speak, of modern instruction in architecture. Two weeks were spent there in visiting its buildings of architectural interest; and the students had an opportunity to see in reality, in the laying out of its boulevards, gardens, and public squares, architectural features they had known before only on paper.

From Paris a visit was made to the châteaux in the valley of the Loire. In the châteaux of Blois, Chambord, Amboise, Chenonceau, Loches, Azay-le-Rideau, and Langeais, the students had excellent examples of that type of French architecture full of historical as well as architectural interest. The last two weeks were spent in England, in London and in the towns of Warwick, Oxford, and Chester on the way to Liverpool.

The principal idea in taking the students to Europe had been, first, to give them a chance to see what architecture has been, and then, if possible, to make them realize what architecture is. As mentioned before, part of the time was devoted to sketching. Good examples of composition, proportion, and good use of materials and color, were pointed out wherever it was possible. No hard-and-fast itinerary was laid down, and as much time was spent in a place as seemed profitable to the students.

It is difficult at once to measure the success of such work, so much depends upon the student himself. Something must have been gained, however; and it seems quite certain that all are returning to the department with a greater interest in their work, and with a broader, more definite and intelligent idea of architecture.

H. W. Gardner, '94.

Lowell Institute

Extracts from the Programme for 1903–04

The Trustee of the Lowell Institute, under the will of John Lowell, Jr., maintains annually in the city of Boston various Courses of Free Public Lectures. For the present — the sixty-fifth — season four distinct Series are provided, to all of which admission is free (but only under certain conditions), as follows: —

I. Public Lectures, in Huntington Hall, 491 Boylston Street.

II. School for Industrial Foremen, under the auspices of the Massachusetts Institute of Technology.

III. Teachers' School of Science, under the auspices of the Boston Society of Natural History.

IV. Courses for Workingmen, under the auspices of the Wells Memorial Institute.

PUBLIC LECTURES IN HUNTINGTON HALL

Lowell Institute Lectures, open to the public, will be given this year, as in recent years, in Huntington Hall, Rogers Building, 491 Boylston Street, Boston. The several Courses will be announced in advance, with full particulars, in the Monthly Bulletin of the Boston Public Library and in the advertising columns of the Boston *Evening Transcript*.

A NEW PLAN OF TICKET DISTRIBUTION

Tickets will hereafter be distributed to the public, free of charge, as follows: —

Admission tickets to the first lecture of each Course will be mailed in the order of application, one to each applicant, until the supply is exhausted, to all persons applying by letter, more than two days before the beginning of any Course, to the Curator of the Lowell Institute, 491 Boylston Street, Boston, and enclosing a stamped, addressed envelope.

On and after the day on which a Course begins any tickets *left over* for that Course may be obtained from the Janitor of the Lowell Institute at 491 Boylston Street, between the hours of 10 and 12 A.M. and 2 and 4 P.M., or by sending to the Curator, with a specific request for such *left-over* tickets, a stamped, addressed envelope.

☞ *No tickets of any kind will hereafter be distributed at the Cadets' Armory; and no tickets will be given out by the Janitor of the Lowell Institute for any Course, before the day on which that Course begins.*

Any person attending the *first Lecture of any Course* may, before entering or after leaving the Hall, exchange his *Admission ticket to the first Lecture* for a *Course ticket*, which, as far as possible under the following arrangement, will entitle its holder to a reserved seat.

In order to make the distribution fair and to avoid a rush for the best seats, all Course tickets will be placed beforehand in sealed envelopes, some containing one ticket good for one reserved seat, some containing two or

more tickets good for adjoining reserved seats, and (if the demand for tickets to the first Lecture exceeds the number of reserved seats) some containing Course tickets good for *Admission* only. All envelopes will then be thoroughly shuffled, and at the first Lecture of any Course those who desire to do so may exchange their Admission tickets at tables in the lower hall for envelopes (shuffled as above described) containing *Course* tickets. Persons wishing to sit together may, by surrendering their Admission tickets at the same time, obtain envelopes with tickets for adjoining seats.

The exchange will begin at 7.30 P.M., but at 7.55 P.M. all exchange of Admission tickets for Course tickets will cease until after the Lecture. Persons arriving after this time, but before the doors are closed, may obtain *admission* to the Hall, and may exchange their Admission tickets to the first Lecture for Course tickets after the Lecture is over.

A limited number of persons having no tickets of any kind may, as heretofore, obtain *admission* (and often good seats) by waiting in line in the lower hall at the foot of the stairs.

Persons obtaining tickets which they afterwards find that they cannot use are requested to return them to the Curator or the Janitor for the benefit of other applicants.

The First Course of the present season will be four lectures by Sir Frederick Pollock, LL.D., D.C.L., late Corpus Professor of Jurisprudence in the University of Oxford, England, on The Theory of the State in English Publicists. I. Mediæval and Renaissance Authors. Sir Thomas Smith and the Omnipotence of Parliament. II. Hobbes and Sovereignty. III. Locke. The Constitutional Balance of Powers. Blackstone. Criticism of the Social Contract: Hume. IV. Bentham and the Utilitarians. Revival of Hobbism. Critical Reaction and Modern Idealism. T. H. Green, Sidgwick, L. Stephen.

Mondays and Thursdays at 8 P.M., beginning Monday, October 19.

The Second Course will be eight lectures by George E. Woodberry, Professor of Comparative Literature in Columbia University, on Race Power in Literature. I. Literature in the Race. II. The Race Language of Literature. III. The Titan Myth in Literature. IV. The Titan Myth in Literature (concluded). V. Spenser. VI. Milton. VII. Wordsworth. VIII. Shelley.

Tuesdays and Fridays at 8 P.M., beginning Tuesday, October 20.

The Third Course will be eight lectures by Charles S. Pierce, Esq., Member of the National Academy of Sciences, on Some Topics of Logic bearing on Questions now Vexed.

Mondays and Thursdays at 8 P.M., beginning Monday, November 23.

The Fourth Course will be ten lectures by A. T. Mahan, LL.D., D.C.L., Captain U.S.N. (retired), on The War of 1812.

Mondays and Thursdays at 8 P.M., beginning Monday, January 4, 1904.

The Fifth Course will be eight lectures by Harold C. Ernst, M.D., Professor of Bacteriology in Harvard University, on Bacteria in Modern Medicine.

Tuesdays and Fridays at 8 P.M., beginning Tuesday, January 5.

The Sixth Course will be eight lectures by Edward Channing, Ph.D., Professor of History in Harvard University, on Early American History.

Tuesdays and Fridays at 8 P.M., beginning Tuesday, February 2.

The Seventh Course will be eight lectures by Georg Steindorff, Professor of Egyptology in the University of Leipzig, Germany, on The History, Social Conditions, and Religion of Egypt.

Mondays, Wednesdays, and Saturdays, February 15, 17, 20, 24, 27, 29, March 2 and 5, at 8 P.M.

The Eighth Course will be eight lectures by Dr. William Everett, on The Italian Poets since Dante.

Tuesdays and Fridays at 8 P.M., beginning Tuesday, March 1.

The Ninth Course will be eight lectures by James Hardy Ropes, Professor in Harvard University, on The Apostolic Age in the Light of Modern Criticism.

Mondays and Thursdays at 8 P.M., beginning Monday, March 7.

The Tenth Course will be six lectures by Dr. Hans Gadow, F.R.S., Lecturer on Zoölogy in the University of Cambridge, England, on The Coloration of Amphibia and Reptiles.

Tuesdays and Fridays at 8 P.M., beginning March 29.

II. SCHOOL FOR INDUSTRIAL FOREMEN

Under the auspices of the Massachusetts Institute of Technology. Described elsewhere in the REVIEW.

III. TEACHERS' SCHOOL OF SCIENCE

Under the auspices of the Boston Society of Natural History.

Free Lectures maintained by the Lowell Institute in the Teachers' Schoo of Science of the Boston Society of Natural History will be given during the season as follows : —

1. Field Lessons in Botany, by Mr. Hollis Webster.
2. Field Lessons in Zoölogy, by Mr. Albert P. Morse.
3. Field Lessons in Geology, by Professor George H. Barton.
4. Laboratory Lessons in Botany, by Mr. Hollis Webster.
5. Laboratory Lessons in Zoölogy, by Mr. Albert P. Morse.
6. Laboratory Lessons in Geology, by Professor George H. Barton.

The Field Lessons will be given in the spring and autumn. The Laboratory Lessons will be given in the winter, beginning on November 21.

Further particulars, with instructions how to secure tickets, may be obtained by sending a stamped, addressed envelope to the Curator, Teachers' School of Science, Boston Society of Natural History, Boston.

IV. COURSES FOR WORKINGMEN

Under the auspices of the Wells Memorial Institute.

Free instruction, especially arranged for workingmen, will be maintained by the Lowell Institute during the winter, under the auspices of the Wells Memorial Institute, as follows: —

1. On Practical Electricity. Twenty lectures for Beginners. By Professor William L. Puffer.
2. On Mechanical Drawing. Twenty lectures for Beginners. By Mr. Harrison W. Hayward.
3. On Machine Drawing. Twenty lectures for Advanced Students. By Mr. Harrison W. Hayward.
4. On Practical Mechanics. Twenty lectures. By Mr. Harrison W. Hayward.
5. On Steam and Steam Engines. Twenty lectures for Beginners and Advanced Students. By Mr. Thomas Hawley.
6. On Domestic Economy. Fifteen lectures. By Miss Anna Barrows.

Further particulars, with instructions how to obtain admission, may be obtained by sending a stamped, addressed envelope to the Secretary, Lowell Free Courses, Wells Memorial Institute, 987 Washington Street, Boston.

THE GRADUATES

THE NORTH-WESTERN ASSOCIATION

CHICAGO, Oct. 10, 1903.

TECHNOLOGY REVIEW,
Boston, Mass.

Gentlemen, — Your telegram of the 7th I find awaiting me on my return to the city. The matter of the proposed excursion was taken up by the executive committee of the North-western Association, who decided that, in accordance with the plans talked over with Dr. Pritchett, Dr. Tyler, Professor Robbins, and the writer last month, the best thing would be to hold such a meeting next June at the time of Commencement. The North-western Association appointed the following committee to promote the same: Solomon Sturges, '87, Samuel Felton, '73, T. W. Robinson, '84, and V. R. Lansingh, '98.

The idea is to get all the Alumni Associations working in conjunction, and to hold a grand reunion of alumni from all parts of the country at that time. The railroads have already promised reduced fares for the occasion; and the Institute, through President Pritchett, will probably be able to furnish the Technology Chambers for the alumni.

The general plan is to spend at least three days in Boston, one evening devoted to class reunions, rooms for the same being obtained in the immediate vicinity of the Institute Building, another evening devoted to a grand reunion and banquet of the entire Institute alumni. In addition there will probably be trolley rides, and possibly at night an attendance at the Pop concert, and other things which will develop later.

The following may be of interest to you in regard to the last meeting of the North-western Association. This was held June 20 at the Onwentsia Club, the finest suburban club in the vicinity of Chicago. A special car was provided, as well as an orchestra; and the men had a fine time going out as well as coming back. 'Busses took the 60 men present to the grounds, where those who were interested in golf enjoyed one of the finest 18-hole link courses in the country. In addition there were tennis, base ball, squash ball, and all sorts of outdoor sports for those who did not bring their golf clubs, besides indoor sports, such as swimming, gymnasium, and other forms of recreation.

When it grew dark, we all sat down to a splendid dinner on the veranda of the club-house. The table was magnificently decorated with Tech colors, and the flowers were appropriately chosen to match the same. The menu cards were novel, and the speakers entirely up to the standard set by the North-western Association.

The entire expenses of the trip were provided by our president, Mr. Sturges, '87, through whose courtesy we became the guests of the Onwentsia Club.

This meeting proved to be perhaps, on the whole, the most popular one the North-western Association has had for a long time, and the entire credit belongs to Mr. Sturges, who so royally entertained us.

Trusting that the above information will thoroughly answer your questions, I remain, Very truly yours,

VAN RENSSELAER LANSINGH, '98,
Secretary N. W. A. M. I. T.
18 E. Adams St., Chicago, Ill.

THE TECHNOLOGY CLUB OF NEW YORK

The meetings during the summer months have been excursions in the vicinity, to which ladies were invited. The July meeting included a trip to Fort Wadsworth and a dinner at Lazarri's. The August meeting was held at the Inn, Long Beach, and the September meeting at Cables Hotel, Midland Beach.

The following have been elected members: H. W. Alden, '93, A. W. Tidd, '94, W. E. Spear, '94, G. E. Howe, '95, T. H. Wiggin, '95, N. F. Rutherford, '96, D. E. Edgerly, '99, H. D. Jouett, '00, C. B. Hammond, '01, R. H. Howe, '03, and H. W. Goddard, '04.

The meeting on the 10th of October was a house-warming at the new club-house, 36 East 28th Street. Members of other Technology clubs are given the privileges of the club-house during visits in the city upon presentation of letters from their secretaries.

ALEXANDER RICE MCKIM, '85, *Secretary-Treasurer.*
36 East 28th St., New York, N.Y.

MERRIMACK VALLEY TECHNOLOGY ASSOCIATION

No meetings of the above society were held during the summer, but an informal meeting and smoke talk was held on Tuesday evening, October 6, at the Essex House, Lawrence. Mr. P. A. Dougherty, president of the Technology Club of Washington, was the guest of the evening. Although the attendance was limited to a very few, yet a most enjoyable evening was spent. Mr. Dougherty told of the work and method of the Washington society, and suggested how the men might be induced to come to the meetings. He also spoke of the part Technology men are taking in the formation of a University Club in Washington, and it is very evident that the M. I. T. men of our capital are not lacking in spirit and enthusiasm for their Alma Mater.

JOHN A. COLLINS, JR., '97,
79 Tremont St., Lawrence, Mass.

NEWS FROM THE CLASSES

1870.

PROF. CHARLES R. CROSS, *Sec.*, Mass. Inst. of Technology, Boston.

Frederick Page has been located in Cape Breton for the past two years, as Superintendent of Construction of the Mabon and Gulf Railway Company.

1872.

C. FRANK ALLEN, *Sec.*, Mass. Inst. of Technology, Boston, Mass.

R. H. Soule is contributing to the *American Engineer* (edited by G. M. Basford, '89) a series of articles on Railway Shops, a line of work which Soule makes a specialty. His previous experience as master mechanic on more than one railroad, and his former presidency of the Master Mechanics' Association, together serve to make him readily sought, for this work, by the officials of railroads. —C. Frank Allen has recently published a new book, "Field and Office Tables," which is especially adapted to railroad work. A new edition of "Railroad Curves and Earthwork" appears at the same time.

1873.

SAMUEL E. TINKHAM, *Sec.*, City Hall, Boston, Mass.

Frank Bowditch Morse died in the City of Mexico, Feb. 18, 1903.—Following is an extract from an article, "Presidents that Push," by Forrest Crissey, in the (Philadelphia) *Saturday Evening Post* for May 30, 1903: —

Probably Mr. Felton is as good an example of what is sometimes called "railroad precocity" as may be found in the country. At twenty years

he was a chief engineer, at twenty-one a general superintendent, at twenty-nine a general manager, at thirty-two a vice-president, and at thirty-seven a president. . . .

But President Felton had one distinct advantage. He came of sound railroad stock, his father being one of the veteran presidents of the Atlantic seaboard. Before he was ten years old, young Felton knew every piece in a locomotive and could give points in construction to the average section boss. . . .

Although at fifty Mr. Felton is accorded a reputation as a "construction president" scarcely eclipsed by that of any man in America, he feels — according to the testimony of his intimates — almost as great a personal pride in the fact that he is a graduate of "Tech" (the Massachusetts Institute of Technology) as in any of his achievements as a builder of railroads. His loyalty to this famous engineering and scientific school is intense, and he will warm to any caller who has won honors in this institution. Vacation intervals, during his school years, were employed in hard service "in the field," with a surveying gang, as rodman, leveller, transit man, and field engineer. He began to "draw railroad money" at the age of fifteen.

Up to the time when he found an opportunity to show his hand in reconstruction his record of advancement reads: Entered service August, 1868, as rodman; 1870, leveller and assistant engineer, Lancaster road; 1872, engineer in charge of surveys, Chester & Paoli Road; 1873, chief engineer, Chester & Delaware River Railroad; 1874, general superintendent, Pittsburg, Cincinnati & St. Louis Railway.

This brought him to the position of general manager of the antiquated New York & New England Railroad, with which he began the year of 1882. In opening the Hudson River extension of that line and improving the entire road, he demonstrated his capacity for constructive work so effectively that in February, 1884, he was made assistant to the president of the New York, Lake Erie & Western, in special charge of the New York, Pennsylvania & Ohio Railroad, which was in a dilapidated condition. Here he accomplished a task of rehabilitation which brought him still greater reputation.

Then came his first important traffic position, as vice-president of the New York, Lake Erie & Western Railroad Company. Another year made him first vice-president of this line, in charge of both traffic and operation.

His first presidency was that of the East Tennessee, Virginia & Georgia

Road and the Cincinnati, New Orleans & Texas Pacific Railway. After the failure of the Richmond & West Point Terminal System, which controlled the above lines, he became receiver of the Cincinnati, New Orleans & Texas Pacific.

This property was, in the phrase of the time, an "artistic wreck," both physically and financially. Before 1900 he turned the road back to its owners with road-bed and equipment in thoroughly first-class condition, and entirely divested of its huge burden of debt, and with money in its treasury. And this remarkable task was accomplished in the years of general panic and financial depression, beginning in 1893 and ending in 1899,— a feat which has been the marvel of the railroad world.

Mr. Felton was made president of the Chicago & Alton Road in September, 1899. Here his problem was practically that of making a first-class road out of "two streaks of rust and a right-of-way." Bridges were too light to carry modern equipment, locomotives were of the old-fashioned pattern, and the cars of small capacity.

At once he ordered fifty new locomotives and over five thousand modern cars. Then he proceeded to rebuild the road, one division at a time. This involved new bridges also. To develop an adequate business for a reconstructed line implied a big increase in tonnage, and this could be profitably handled only by cutting down grades and reducing tonnage cost by the soundest constructive work. Now this labor on almost one thousand miles of road is practically finished. The coal business of the line, under Mr. Felton's direct management, has jumped from $19,000 in October, 1898, to $127,000 for the corresponding month in 1902; the freight earnings, from $370,000 in October, 1898, to $470,000 in October of last year; and the passenger earnings in the same time, from $221,000 to $282,000. He has spent about twelve million dollars in three years in equipment,— bridges, rails, ballasting, signals, frogs, and switches, side and double tracks, yards and round-houses,— remodelled shops and stations, and all the improvements necessary to convert a line that had been living in the past into a road unsurpassed in its physical condition by any in the West. That this work of reconstruction amply provides for the future is indicated by the fact that its average of tons per train mile in 1898 was 187 as against a present average of 382. What this means will be best understood by the practical railroad man: probably it cannot be fully appreciated by the lay mind.

1875.

E. A. W. HAMMATT, *Sec.*, 10 Neponset Block, Hyde Park, Mass.

The secretary, while on a trip to New York, met the following men: E. H. Gammans, who is living at 110 Lafayette Avenue, Brooklyn. Frank T. King, at 26 Broadway; and Frank T. Sargent, at 99 Nassau Street. Also met H. D. Hibbard, '77, and at the new club-house of the Tech Club of New York Mr. McKim, '85. John Cabot has apparently left the city, as he was not at the address given to the secretary some two years ago or at that given by the city directory.

1876.

JOHN R. FREEMAN, *Sec.*, 145 Morris Avenue, Providence, R.I.

Professor W. O. Crosby spent the early part of the present summer in part on studies of Long Island for the United States Geological Survey. After the close of the Institute year he started for Cape Nome, Alaska, to investigate some geological problems in the interests of mine owners. Only two weeks en route from Boston to Nome! Such is 20th century transportation. He was back at the opening of the term.— Mr. Theodore Swartz has spent some time recently investigating mines in Chihuahua, Mex., but has now returned to Denver.— Lorenzo M. Davis of the "Civils of '76" has just been East on a brief visit. Mr. Davis was prominent for many years on the engineering corps of the Canadian Pacific and the Sault Ste. Marie Railroads, having charge of much important construction, and in the natural course of events would have to-day been chief engineer of the "Sault," had he not become tired of engineering work on the extreme frontier, and resigned about five years ago. While building the "Sault" road through Minot, No. Dak., he became interested in the coal outcrop, and, after resigning from the road, engaged in coal mining in a modest way, and is now a half-owner in a prosperous mine that works from fifty to one hundred men, according to the season. He has also

been branching out in other lines of business. Two years ago he established an electric light and power plant and a telephone company, both of which are prospering under his management. With a few partners he is now building up a long distance telephone service with local exchanges along the Great Northern and Sault roads for a hundred miles each way from Minot, and reports that he finds the life of a business man much more comfortable than that of a pioneer in railroading.— The following is from the Minneapolis *Journal* and the Marshall *Messenger*: —

Clarence Miles Boutelle, superintendent of the Marshall public schools for eight years and one of the best-known and most successful educators of Minnesota, died suddenly about eleven o'clock P.M., September 17, from heart failure.

Yesterday afternoon one of the largest Masonic funerals ever held in this section was conducted by the Knights Templar, Boutelle marching with the Knights to the cemetery. It was a long, hard walk, and he returned much fatigued. He retired early, and his wife was awakened about eleven o'clock by his deep breathing. He died before medical assistance could reach him.

He was a native of New Hampshire. Was born in 1851, coming to Minnesota in 1859 with his parents, who settled on government land. Clarence led the ordinary farm life of a country boy until nineteen, taught a district school for two winters, then entered the State Normal School, graduating in 1872. He then spent two years at the Massachusetts Institute of Technology, and returned to become a member of the faculty of the Minnesota State Normal School at Winona, teaching mathematical and scientific branches. He was for nine years a member of the faculty of the State Normal at Winona, and seven years superintendent at Decorah, Ia. He had been superintendent here since 1895, and for the past seven years had been an instructor in the State University summer school in Minneapolis.

He was an author of some repute, contributing regularly to various magazines, and often to the Chicago *Tribune*, *Times*, and *The Courant*, and was a well-known Masonic writer. He was a member of the Knights Templar and Odd Fellows. On July 22, 1890, he was married to Miss Fannie C. Kimber, a graduate of the Oswego (N.Y.), State Normal College, and until that time in charge of methods and practice teaching of the Minnesota State Normal School, and recognized as in the very front rank of

normal teachers in this State. His wife and two daughters survive. The latter are now in the university. The funeral was under Masonic auspices, with burial at Lake City, his former home. The public schools were closed, and the school children and teachers attended the funeral services at the Episcopal church, in token of the esteem in which he was held.

Boutelle was held in kindly remembrance by his classmates of Tech '76 for his earnestness and remarkable ability as a student and for strength of purpose. It was always a matter of great regret to him that from financial reasons he was unable to complete his course and graduate with the class; and nearly twenty years afterwards he came to Boston, and consulted with Professor Holman and others about taking a year's residence here, in order to take lectures, present a thesis, and become a candidate for a degree, so steadfast was he in the desire to finish a course once well begun. He corresponded occasionally with the class secretary, was always appreciative of news from Tech and of the success of his classmates, and in every way most loyal to Alma Mater.

1882.

WALTER B. SNOW, *Sec.*, Russell Avenue, Watertown, Mass.

The following clipping is from the Boston *Herald* of July 18: —

Information was received yesterday of the death, at St. Moritz, Switzerland, Thursday, of George Foster Shepley, of Brookline, of the well-known firm of Shepley, Rutan & Coolidge, architects of this city, Mr. Shepley, who was visiting the Continent for the benefit of his health, was forty-three years old, and leaves a widow (the daughter of the late H. H. Richardson, architect of Trinity Church), two daughters and three sons.

Mr. Shepley, who was probably one of the best-known architects in this country, was born at St. Louis, Mo., Nov. 7, 1860. He was a student at Washington University, and afterward graduated from the Massachusetts Institute of Technology in 1882. Then he entered the office of H. H. Richardson, the architect, and there continued his studies under the able direction of Mr. Richardson until the latter's death. With Messrs. Rutan and Coolidge, who were also employed in the office, Mr. Shepley carried out the large work left uncompleted by Mr. Richardson.

The firm of Shepley, Rutan & Coolidge, which was then formed, has proved to be one of the representative architectural firms in this country. Among the many imposing buildings the firm has designed are the Ames

Building, the Chamber of Commerce, South Terminal Station, Back Bay Station, new Congregational House, various mercantile buildings, the new Harvard Medical School building, to be erected at Longwood; the Art Institute, Chicago; Leland Stanford, Jr., University, California; new Union Station, Albany; and many fine residences throughout the country.

It is not known whether Mr. Shepley's body will be brought to this country for burial.

1883.

HARVEY S. CHASE, *Sec.*, 27 State Street, Boston, Mass.

The reunion of '83 on June 25, 26, and 27, was successful. A number of the men announced that they had "the time of their lives." Dinner at Tech Club Thursday evening; next day and night at Misery Island Club, off Beverly shore; steamer to Boston on Saturday morning, with the sea like a mill-pond; visit to the new buildings and laboratories of M. I. T.; automobile ride along the boulevards to Riverside, including preliminary "smörgåsbord" at the secretary's home; final dinner at the Newton Club, and a bowling match afterward,— made up an aggregation of ecstasies not often afforded. Photographs were taken of the benignant, blameless, and bearded bacchantes, as well as of the smooth-faced variety of virile, vehement, and vociferous valetudinarians. These will be preserved (in sarsaparilla) for future generations. It was voted to hold another reunion at the earliest date possible. Probably 1904, at St. Louis Fair, will fill the bill.

1887.

EDWARD G. THOMAS, *Sec.*, 4 State Street, Boston, Mass.

Tappan has moved to Dante, Russell County, Va., where he is resident engineer and assistant superintendent of the Lick Creek & Lake Erie Railroad and the Dawson Coal and Coke Company. He has in his charge about 6,000 acres of coal lands and 13 miles of railroad.— Gerrish spent the summer at Camp Ossipee, Wolfeboro, N.H.— H. F. Bryant, in connection with other work, is act-

ing as engineer for the Chittenden Power Company at Rutland, Vt., and the Hoosac Power Company at Reedsboro,— two large hydraulic and power transmission schemes, the former having 2,000 H. P. and the latter 2,500 H. P. available at low water. The head at Reedsboro is 840 feet.— Stewart spent the summer at his home in Everett, but has now returned to Pine Bluff, N.C., for the winter.— Wilcox is now acting as superintendent of the concentrators of the Smuggler & Durant Mining Companies at Aspen, Col., in addition to his work as mining engineer for these companies.— Coombs is now connected with the engineering force of the New York Central Railroad Company, and is located at Room 512, Grand Central Station.— Souther has incorporated his business under the name of The Henry Souther Engineering Company, Engineers, Metallurgists, and Analysts, office at 440 Capitol Avenue, Hartford, Conn. Souther is president and treasurer, and C. S. Dunbar (Sheffield Scientific School) is secretary. The company acts as consulting engineers for many manufacturers of New England, inspecting the materials purchased by them and their products, with the idea of getting uniformity. They have, as clients, foundries, machine shops, automobile manufacturers, contractors (mostly on cement work), water-works, and sewage disposal plants. An interesting work has just come to them in an appointment for Souther to act as one of the board of examiners to inspect the automobiles that enter the New York, Buffalo, Cleveland, and Pittsburg endurance run, which starts October 6 from New York. He is associated on the board with Professors Carpenter, of Cornell, and Cooley, of the University of Michigan. The idea is that this board shall accompany the machines during the run, and note and inspect the condition of the machines as far as real depreciation of the working parts is concerned. This element has never entered into any previous endurance test, and the information gained ought to be valuable to the whole industry. At the end of the run the machines will all be turned over to the board without any attention whatever, and enough time will be taken to thoroughly get at their real worth. Two 1903 men are employed by the company,— Strong on metallurgical analysis and

Currier on sanitary analysis of water,— and Souther says they are doing the " usual good work of Tech men." — Mossman has been transfered from the Eilers Plant of the American Smelting and Refining Company, and has been placed in charge of the Arkansas Valley Plant at Leadville, Col. This is one of the most important smelters in Colorado.— Hobart writes that he spent July on Cape Cod, and is now going to Fifield, Wis., with Mrs. Hobart, to give her a chance at a 50 lb. muscalonge. His only business trouble is to find quarters to allow the Triumph Electric Company to catch up with their orders.— Brace has recently made an examination of all the important zinc districts of the Rocky Mountains in the United States and British Columbia; and he has been conducting experimental work in investigations on the metallurgy of these complex Western zinc ores, especially with reference to the magnetic and static electrical processes of separation. He is making a specialty of the metallurgy of zinc ores, although his work includes the examination of mines of all sorts for investors.— The Denver Engineering Works, of which Shepard is president, are now pushing the Box Electric Rock Drill, which will do as much work with 2 H. P. as compressed air machinery with 15. They have also designed a complete line of electric hoists from 150 H. P. down. Shepard has recently designed a large concentrating plant for the Gold King Mine of Silverton, which will be installed during the coming spring. Wakefield has been notified by the Secretary of the Treasury of the acceptance of his plans for the erection of a $65,000 post-office building at Nashua, N.H. The building is to be 90 x 60 feet, and will be built of granite and New Hampshire limestone. Wakefield's success is especially gratifying to him, as plans were submitted anonymously by six architects, so that the choice was certain to have been made on the merits of the design. — Shepard sends me a letter from Sidney Bartlett, from which I quote: —

I am down here in Kansas, sinking oil wells as fast as we can. Sometimes we get one, sometimes we don't. We are running four strings of tools, and have 15,000 acres of land under lease, which, we confidently expect, will make us all millionaires. I have expected these things before, though, and have seen them fail to materialize.

The twins will be seven years old this winter, and we have had another baby boy, who died last August. My home address now is 1130 Wood Avenue, Colorado Springs. . . .

Bartlett's company is the Vulcan Oil and Gas Company of Independence, Kan.— In response to a query for news from Sturges, I received a note, of which the following is a portion : —

I know very little about the doings, especially of the '87 Tech men. There seem to be none out here who is distinguishing himself particularly. They are all leading good, industrious lives, sober generally, making enough to live on, not ambitious for newspaper notoriety. In fact, they are the good class of citizens which advance Americanhood. We have no rakes, as we have passed over that stage. We have no ministers, because we are not good enough. We all do, however, believe there is a God, though our ideas of him may vary. We have gained the respect of our neighbors, but probably not their enthusiastic admiration. A man seldom gains admiration without enemies. Tech men are too slow to gain enemies, and they follow trades where they are brought into so little contact with the world at large they know nothing about the superficial side of life, and therefore are uninteresting, dull, heavy. The Institute should have a course "Politics" in its curriculum, so that some of its men could be before the public. . . . Boston is too big for the Institute, and it is much too small. We ought to move into the country *without delay*. That is the prevailing opinion of all the Tech men here. The Institute has been run long enough on old-fogy ideas. Our buildings are too sombre : they need a little white-stone and red-roof effect. I remember the first time I entered Rogers, and the invisible yet glaring sign over the doors, "Lose all hope, ye who enter here." The place lacks life,— indeed, it does. The most enthusiastic Tech men are those who have left it. The management should encourage a little enthusiasm while they are undergraduates. I liked our class because there were some devils in it. At forty a man can begin to be a little serious, but he should not be forty at eighteen.

— From the Paterson (N. J.) *Call*, Sept. 25, 1903 : —

Jonas Waldo Smith was appointed chief engineer to the Aqueduct Commission yesterday, to succeed William R. Hill, who recently resigned on the plea of ill-health. Mr. Smith will receive a salary of $12,000. Mr. Hill got $8,000.

Jonas Waldo Smith, who was yesterday appointed chief engineer to the Aqueduct Commission of New York, is superintendent of the Passaic Water Company of this city, and the East Jersey Water Company. Mr. Smith took charge of the Passaic Water Company in 1897, coming here from Montclair, where he had been superintendent of the water company there for several years.

Mr. Smith was born in Lincoln, Mass., and was educated in Phillips, Andover, Mass., and at Massachusetts Institute of Technology. He is only thirty-eight years of age, and has been with the East Jersey Water Company as an engineer almost since his graduation from college. He started as an ordinary civil engineer ; but his great aptitude for construction work, as shown in the earlier Canistear and other of the East Jersey Water Company reservoirs, soon made him an indispensable man in the councils of the company that has, in turn, supplied Newark, Jersey City, Paterson, Passaic, Montclair, and other places with a pure water supply.

Older heads gave way to Mr. Smith's genius in his chosen work. His plans and specifications for controlling the waters of the Northern New Jersey watersheds were acknowledged by men familiar for years with the work to be far superior to others, and it was but a short time when the older men were looking to the young engineer for guidance.

1888.

WILLIAM G. SNOW, *Sec.*, 245 N. Broad Street, Philadelphia, Pa.

Frederick R. Nichols, instructor in physics in the Richard T. Crane Manual Training High School, Chicago, attended the meetings of the National Educational Association held in Boston in July.— W. S. Aldrich is now with McKim, Mead & White, New York. He has recently joined the Tech Club of that city.— Henry C. Moore is at 418 Fifth Avenue, New York City.— C. H. Mower, of 147 Queen Victoria Street, London, writes that he has become much interested in automobiling, and is a member of the Automobile Club of Great Britain and Ireland.— William T. Keough, consulting engineer and naval architect, has removed his office to 508 Board of Trade Building, 131 State Street.— The fifteenth annual reunion of the class, held on June 20, was a great success, and thoroughly enjoyed by those present, namely : Bates,

Bradlee, Blanchard, Blood, Bridges, Belser, J. C. T. Baldwin, Child, Cole, Dempsey, Fuller, Gage, Gould, Hamblet, Holman, Heath, Lee, Pierce, Robb, Runkle, Sawyer, Shaw, Snow, Stone, Sweetland, Thompson, Webster, Williams, Wood. These twenty-nine men, except a few who could only be present in the evening, took a special car and, under the guidance of Charles A. Stone, inspected prospective sites for the Institute in Allston, Watertown, and Cambridge. The general opinion appeared to decidedly favor the location in Watertown on the banks of the Charles River, where an ample area may be procured at reasonable cost. At Lexington the class had luncheon, after which a baseball game took place, which was called on account of rain, leaving the result uncertain. It proved very enjoyable while it lasted. After spending the afternoon in this old town with Shaw — a native — as a guide, the class returned to the Technology Club to the annual dinner, at which President Pritchett was the guest of honor. It was the first opportunity several of the members had had, since leaving Tech, of meeting their classmates. It is hoped other reunions will give as much pleasure to those who attend.— Stephen Child has recently opened an office at 2A Park Street. He is a landscape architect and consulting engineer.

1889.

WALTER H. KILHAM, *Sec.*, 9 Park Street, Boston, Mass.

F. W. Hobbs is a member of the Brookline School Board.— W. L. Smith has moved into his new house at Concord, Mass., which was designed by Kilham ('89) & Hopkins ('96).— Hollis French writes as follows: —

With reference to your inquiry as to our work, I can only say that, while we have more on hand than ever before and are particularly busy with the city school-houses, having been retained by the city for all of them, the most interesting piece of work which we are doing is that at Garvins Falls, N.H., on the Merrimac River, about three miles below Concord, N.H.

At this point there is now under erection from our plans a masonry dam

about 575 feet long, in order to utilize the 30-foot head at this point. On the right bank of the river are the head gates, which are to be built of concrete and open into a canal about 500 feet long. At the lower end of the canal is a power station where six (6) 1,000 horse-power turbines will be placed, directly connected to six (6) 50 kw. dynamos generating current at a potential of 13,000 volts. This we transmit to the city of Manchester, nearly fifteen miles below.

About two years ago we put in at Garvins Falls part of the station to utilize the power, as it was in the old state of development. Up to that time there had never been more than 1,200 horse-power used. Our new plans will, however, enable us to use as large as 6,000.

The contract has been let to the firm of Holbrook, Cabot & Rollins. Mr. James W. Rollins, Jr., of this firm, has immediate charge of this work, and is very well known throughout New England. He is a graduate of the Institute, class of 1878.

The work is going forward with great pressure, as we are anxious to get two of our wheels running by the first of November; and, consequently, they are working day and night.

At the present time the canal has been blasted out and the masonry lining is nearly in. The head gates have been started, a large concrete mixing plant having been set up near them for the purpose of getting them up rapidly. The first stone was laid in the dam last week; and, if we do not meet with bad weather and unexpected difficulties in the nature of ledge, etc., it is hoped that the work can be completed by the first of next year.

No doubt a pretty complete description of the plans and work will be published later, so that, if any of your readers are particularly interested, they can get more details at that time.

Mr. French has just built a charming summer residence at Annisquam, Mass., from plans by Wales ('89) & Holt.

1891.

HOWARD C. FORBES, *Sec.*, 4 State Street, Boston, Mass.

Robert D. Cushing died at Lunenburg, Mass., Aug. 21, 1903. He was a member of the Mandolin Club while in Tech., and all who knew him well liked him exceedingly. For a number of years

he was assistant engineer of the Fitchburg Railroad, and later on the Boston Elevated Railroad and New York Central. He gave up business over a year ago, and returned to his home at Lunenburg.— Kimball, whose engineering office is in the Paddock Building, Boston, has recently returned from Nova Scotia, where he made an examination of some property regarding the erection of pulp and paper mills.— Wilder and Kimball have become directors in the Eastern Fire Protection Company, 101 Tremont Street, Boston, manufacturers and dealers in approved fire protection devices.— Dana and Hersam were both abroad this summer, and met unexpectedly on the steamship "New England," leaving Liverpool July 23. Hersam took a two months' pleasure trip through Italy, Switzerland, Germany, France, and England. Dana went over to attend the International Fire Prevention Congress in London, and read a paper on the "Care of Private Fire Appliances." He also did some travelling in Paris, Belgium, Holland, and England.— Invitations are out for the marriage of Mr. Robert Steel Ball with Miss Olga Sturge at the Friends' Meeting-house, Newcastle-on-Tyne, England, Wednesday, Sept. 2, 1903. Ball has recently severed his connections with the British Westinghouse Company.— Fuger, now captain Thirteenth Infantry, United States Army writes the following: —

My regiment returned from the Islands about a year ago, and we have been stationed in the harbor of San Francisco ever since. I enjoyed so much reading the account of the meeting. I see Cunningham is out this way. I will try and look him up. I look forward to seeing dear old Tech again. I hope I may have the good fortune of being detailed there in about two years as military instructor. I am delighted with California; and, as long as the regiment is stationed here, I don't want to leave it. I won't be so particular, though, when it leaves. Still, I have been with the regiment almost constantly since September, 1901, and since 1898 it has seen a great deal of hard service. We were in the Cuban campaign from beginning to end. In May, 1899, the regiment went to the Philippines, and did not return till July, 1902.

The regular army has been very much changed in the last five years, but I have been in the same regiment constantly. I am now captain of the company I was second lieutenant of. I received my captaincy Feb. 2, 1901.

If you hear of any of the men coming out this way, you must let them know of my whereabouts and ask them to look me up. I have seen Donn quite frequently, also Church and Estey and Hammond. I think these are the only '91 men I have run across since graduating.

— Akin writes : —

I have not yet finished the work I am doing for B. T. Babbitt, and am still living in East Orange, where, by the way, there is quite a colony of Tech men. L. G. French and Burton, '91, both live here.

— Bradlee writes : —

The only thing of interest which occurs to me would be possibly some reference to the water power which we are developing on the Pacific coast. This water power is rather unique in some of its details, and has consequently attracted a good deal of attention. It is located on Mount Rainier, which, as you very likely know, is snow-capped during the entire year and has several large glaciers near the summit. Our water power will be located quite well up on the slope of the mountain, and the river on which it is located obtains its water almost entirely from the melting of the glaciers. This, you will see, furnishes an almost constant source of power. The natural melting of the glacier is more rapid in summer during the pleasant season, when there would be no supply of rain ; and during the rainy season the rainfall makes up for the decrease in the melting of the glacier.

— Garrison has returned from a trip to the St. John Lake region, camping near Lake Edward, for trout fishing. He visited Roberbal, where the Ouiatchouan Falls are situated, which supply the water power for a pulp mill at the foot under a head of 95 pounds. He then went by steamer down the famous Saguenay River to Quebec. A visit was also made to St. Anne de Beaupré and the Montmorenci Falls. The latter are used for two large water-power plants, one of which is an electrical transmission station which sends its current into Quebec, and the other a large cotton-mill at the foot of the falls.— Walter E. Hopton is now located with the purchasing engineer of the Solvay Process Company at Syracuse, N.Y.

1893.

FREDERIC H. FAY, *Sec.*, 60 City Hall, Boston, Mass.

The Decennial Catalogue of the class was published in June; and copies were mailed July 1 to members of the class, the Corporation, instructing staff, and association of class secretaries. Many congratulatory letters have been received in praise of the book, the following from Mr. John R. Freeman, '76, a member of the Corporation, being a typical one: "Accept my thanks and my congratulations for the excellent report and catalogue of the class of '93. It is the best thing of the kind I have ever seen. I am under the impression that I was the first class secretary to start anything of this kind, and I have long since become a backslider; but my reports were very modest affairs in comparison with this one which you have sent me. I am also interested to note the evidence of success achieved in the average salary received by members of your class. I note several familiar names among its members."— Charles V. Allen, electrical engineer with the Westinghouse Electric and Manufacturing Company, and until recently with its foreign department at East Pittsburg, Pa., has been transferred to the company's export sales department at 120 Broadway, New York. Allen's home address is 3 North Twenty-first Street, East Orange, N.J.— Howard Rittenhouse Barton and Miss Ethel Breed Sherman were married at St. Paul's Church, Englewood, N.J., June 18, 1903.— Arthur Augustine Buck and Miss Elizabeth Gould Davis were married April 15, 1903, at the home of the bride's parents, Mr. and Mrs. Owen Warren Davis, at West Brooklyn, N.Y. Mr. and Mrs. Buck reside at 1211 Union Street, Schenectady, N.Y., where Buck is connected with the patent department of the General Electric Company.— The residential address of H. W. Burckhardt is Madison Road, East Walnut Hills, Cincinnati, Ohio.—John C. Clapp, Jr., is head draughtsman for Fox & Gale, architects, 120 Tremont Street, Boston.— Henry Baldwin Dates, since 1896 professor of electrical engineering at the Clarkson School of Technology at Potsdam, N.Y., has been

appointed professor of electrical engineering at the University of Colorado.— Arthur Edwin Fowle and Miss Mary Louise Stevens, daughter of Mr. and Mrs. John H. Stevens of Oakland, Cal., were married in that city on the 11th of June. Mr. and Mrs. Fowle are living at Gomez Palacio, Durango, Mex., where he is superintendent of soap and glycerine factories of the Compania Industrial Jabonera, de la Laguna.— William Gabriel Houck and Miss Julie Emilia Gyer, daughter of Dr. and Mrs. Julius William Gyer, of New York City, were married on the 14th of May. Mrs. Houck is a pianist of rare talent, who has been heard in concerts in many of the largest cities of the country. Since graduating from the Institute, Houck has lived in Buffalo, N.Y., his native city, where at present he is secretary-treasurer and a director of the Buffalo Structural Steel Company, Incorporated. Mr. and Mrs. Houck reside at "The Niagara Falls," Buffalo, N.Y. — Herbert A. Houghton is with the engineering department of the Atlas Portland Cement Company at Northampton, Pa.— The California address of Myron Hunt, architect, of Chicago and Los Angeles, is 415 Lankershim Building, Los Angeles, Cal.— A. L. Kendall served with the First Regiment, Heavy Artillery, M.V.M., during the recent naval and army manœuvres at Portland, Me. His company was stationed at Fort McKinley, Great Diamond Island, and saw much active service. Kendall reports that he was disabled, but not killed.— Charles L. Norton's name has received considerable prominence recently because of his connection with the experimental work undertaken by Edward Atkinson for the purpose of demonstrating the fuel value of marsh mud. Norton has had charge of the experiments, and so far has obtained results which apparently show that ordinary marsh mud, when properly dried, has a fuel power not much inferior to anthracite coal. The field is an interesting one, and, if further experiments do not contradict the results already obtained, it is possible that coal may some day be replaced for domestic consumption by this new fuel.— William S. Resor, with the Central Union Telephone Company, has been transferred from Chicago, his present address being in care of that company, Majestic Building, Indianapolis, Ind.—

Charles M. Spofford has recently received the appointment of assistant professor of civil engineering at the Institute. '93 now has two representatives upon the Institute Faculty, C. L. Norton and Spofford.— Walter I. Swanton is engineer draughtsman in the office of the Supervising Architect of the Treasury at Washington. His address is 1641 Thirteenth Street, N.W., Washington, D.C. — K. S. Sweet has spent the summer in engineering work connected with the extension of the water supply of the city of New York.— At the meeting of the New England Street Railway Club, on May 26 last, P. H. Thomas presented a paper on the new Hewett mercury vapor converter. The meeting was held in the Lowell Building of the Institute, in order to provide facilities for the experimental demonstrations. The mercury vapor converter, as well as the mercury vapor lamp, which was the subject of another paper at the same meeting, is the invention of Mr. Cooper Hewett, of New York, and depends upon the principle that, if an alternating current is passed through mercury vapor of low tension, the current delivered will be a direct current. The possibilities of this type of converter lie in the fact that the electrical losses are directly proportional to the current, and not to the square of the current, as in rotary converters. The apparatus has not reached the commercial stage, but, judging from the experimental apparatus, it is not far from it. It is understood that this work has been taken up by Thomas for Mr. George Westinghouse, and is in addition to his engineering work for the Westinghouse Company.— Harry Hill Thorndike and Miss Lucy Barney Gurnee were married July 29, 1903, at St. Saviour's Church, Bar Harbor, Me., by Bishop Lawrence, of Massachusetts. Mrs. Thorndike is a daughter of Mr. and Mrs. Walter S. Gurnee, of New York. Mr. Thorndike, who is a son of Mrs. George Quincy Thorndike, of 175 Marlboro Street, Boston, graduated at Harvard in 1890, and subsequently studied architecture at the Institute. He is a member of the Somerset and Athletic Clubs of Boston, the Country Club, Brookline, and the Kebo Valley Club and other clubs of Bar Harbor.— Amasa Walker, in May last, resigned his position as New England agent for D. Appleton & Co., to take the

management of the educational business of Longmans, Green & Co., publishers, with headquarters at 93 Fifth Avenue, New York. — Charles R. Walker is a member of the American Electrochemical Society.

1894.

SAMUEL C. PRESCOTT, *Sec.*, Mass. Inst. of Technology, Boston, Mass.

John N. Ferguson, who for several years has been in the engineering department of the Metropolitan Water and Sewerage Board, has been chosen assistant engineer in charge of the office for the Charles River Dam Commission, a position for which he is admirably adapted.— Harry B. Russell was married early in the year to Miss Douglas, daughter of Mr. and Mrs. W. L. Douglas, of Brockton. Mrs. Russell recently christened the large schooner which bears her father's name.— Leslie R. Moore returns to the Institute this year as instructor in general chemistry. After graduation Moore remained a year at the Institute as assistant in industrial chemistry. The next four years he spent in travel and study at Heidelberg. Returning to America, he was chemist for the Mousam Manufacturing Company of Kennebunk, Me., for two or three years, and during the last college year was instructor at Colby University, Waterville, Me.— George W. Sherman has terminated his engagement as superintendent of the Northwestern Rubber Company of Liverpool, Eng., and is engaged in a similar capacity at Akron, Ohio.— Mr. and Mrs. George A. Taber, of 546 East 23d Street, Brooklyn, announce the birth of a son, Wentworth Dearborn, on September 21.

1895.

GEORGE W. HAYDEN, *Sec.*, 493 Warren Street, Roxbury, Mass.

John H. Gardiner has left Boston, and is now located at 21 Barclay Street, New York City, with the same concern as formerly, the J. B. Colt Company.— John Denis Moore was

married to Miss Julia Frances Leader, Aug. 19, 1903, at Lewiston, Me.— Gerard Swope and E. C. Alden were in Boston during the early part of September, and called on the secretary.— On Thursday evening, September 10, the first monthly reunion of the Boston '95 men took place at the Technology Club. Dinner was served at 6.30, and the evening was spent pleasantly in exchanging experiences. Those present were Ames, A. D. Fuller, Eveleth, Booth, Howard, Jackson, J. W. Cooke, Hannah, Swope, C. H. Parker, and Hayden. It is the intention to have regular meetings on the first Monday of each month, and all Boston men are urged to be present as often as possible. '95 men who expect to be in town on that day are requested to communicate with the secretary.— On September 29, at Grace Church in New York, Mr. Robert D. Farquhar was married to Miss Marion Jones. Mr. Farquhar, who is a graduate of both Harvard University and the Institute of Technology, was completing his education at the Architectural Institute in Paris, where Miss Jones was passing the winter with her mother. A courtship of several months' duration terminated in the announcement of their engagement early in the spring. Miss Marion Jones has been a conspicuous figure in New York and Washington among the younger society set. An enthusiastic follower of outdoor sports, she at one time held the woman's tennis championship of the United States. Since returning from his studies abroad, Mr. Farquhar has been connected with the firm of Hunt & Hunt, architects, of New York city.

1896.

E. S. MANSFIELD, *Sec.*, 70 State Street, Boston.

Charles E. Locke was married in Montreal, on June 30 last, to Miss Louisa Stewart, of that place. Mr. and Mrs. Locke are now residing in Brookline, Mass. During the month of June, Mr. Locke accompanied the Metallurgical Summer School, which visited Port Henry, Syracuse, and Buffalo in New York State, also Cleveland, Ohio.— A letter from C. A. Wentworth states that he has been

transferred from the Brooklyn Navy Yard to the Bureau of Yards and Docks at Washington, where he has charge of the draughting room. All the plans for public works in this department, such as buildings, quay walls, railway, sewer, and water systems, together with correspondence and specifications for the same in process of construction by the Navy Department at the various yards, are referred to him for examination and approval. The special work engaging Mr. Wentworth's attention at the present time consists of completing the plans for a new concrete dock to be built at the New York Navy Yard.— Invitations for the wedding of E. Arthur Baldwin and Miss Anne Edwards Greenleaf, of Newburyport, were issued for the 15th of October, to take place at Newburyport, Mass. Among the ushers to officiate at the wedding were Hurd, Stearns, and F. W. Fuller, '96, George A. Fuller, '97, and E. B. Raymond, '90. After the usual wedding tour, Mr. and Mrs. Baldwin took up their residence in Schenectady, N.Y.— F. A. Thanisch, who for the last two years has been located in Boston, sailed from San Francisco on June 27 for the Philippine Islands, where he is to act as mineralogical expert for the United States government.— Charles S. Newhall, of Ouray, Col., is at present engaged in a contract for sinking the Camp Bird shaft in that place.— The Ferro-concrete Company, of which W. P. Anderson is president, is engaged in the erection of a concrete building in Cincinnati, Ohio, which is one of the first of its class in the country.— H. S. Baldwin is now connected with the General Electric Company, and is located at Lynn, Mass.

1897.

JOHN A. COLLINS, Jr., *Sec.*, 79 Tremont Street, Lawrence, Mass.

Jesse W. Shuman, VI., was married on June 23 to Miss Martha Rogers, of Minneapolis, Minn.— Robert M. Ferris, Jr., was married on September 16 to Miss Adah Crump, of Poughkeepsie, N.Y.— A. L. Parsons, formerly with the Government Printing Department at Washington, has received the appointment of civil engineer with the Navy Department, and has been ordered

to the Pacific Coast on work connected with the new navy yard. — At the time of this writing, cards are out for the marriage of Russell Spring to Miss Helen Spooner, of Methuen, Mass.— About the first of October the secretary was pleased to have a call from Proctor L. Dougherty of the Electrical Inspection of the Post-office Department at Washington. Mr. Dougherty has been on a business trip in Maine. He reports Technology affairs as being in a very flourishing condition in Washington, where he is President of the Techology Society. It seems that there is a scheme on foot to establish a University Club there, and the Technology Club is taking a prominent part in carrying on the work of organization.

1898.

C.-E. A. Winslow, *Sec.*, Hotel Oxford, Boston Mass.

E. Johnson, Jr., is in charge of the Chicago office of the Hydrographic Survey, engaged in the study of water supply and water pollution. He is to be married about the middle of November.— W. L. Butcher's engagement has just been announced.— M. deK. Thompson took his degree of Doctor of Philosophy in Chemistry at the University of Basle in July, and has returned to the Institute as an instructor in electrochemistry.— A. A. Blanchard has also joined the Institute staff as instructor in general chemistry.— R. S. Allyn was married during the summer.— A. Sargent has taken a room in the new Technology Club-house in New York.— C. F. Drake is to remain in Philadelphia as a permanent official of the Water Department.— C. H. Pease is chairman of the '98 Committee on Informal Reunions. Those who think it time one of these meetings was held should communicate with him.— S. S. Philbrick, chairman of the '98 Class Book Committee, is sending out a preliminary circular letter asking for opinions as to the advisability of including photographs of the members of the class.— E. S. Chapin was married to Miss Margaret Crossman, daughter of Mrs. Edward F. Littlefield, on Tuesday, September 8, in the Union Congregational Church, Columbus Avenue,

Boston. They will be at home after November 1 at 51 Myrtle Street, Winchester.— E. B. Richardson was married Thursday, September 24, at the Union Chapel, Magnolia, to Miss Elsie Greenwood, daughter of Captain and Mrs. John Elliott, Pillsbury, U.S.N.

1900.

GEORGE EDMOND RUSSELL, *Sec.*, 25 Broad Street, New York, N.Y.

Class news has been at a premium for some time past, owing to failure of many to write the secretary, informing him of change in business, address, or new work undertaken. It would give material aid and interest to these columns if the men would take the trouble to do this.— L. A. Crowell has started a fish-freezing plant near East Dennis, and, according to last reports, is in line with a large business.— Too late for the last REVIEW came a long and interesting letter from W. W. Stone, now employed as assistant engineer in New York State. Upon graduating, it will be remembered, he accepted a position at Washington, D.C., where he was engaged for two years in drainage work for the city. Following the completion of the work there, he was appointed to his present position, where he has been for a year past.— A. C. Redman is located in the "wild and woolly West" as irrigation engineer on the Geological Survey. As assistant to G. Matthes, '95, he has been engaged in investigating the water supply for several cities and constructing public buildings. His last letter was dated from Oklahoma Territory, and contained the information that late this fall he should start on a trip into the farther West.— F. D. Chase is with the Minneapolis & St. Louis Railroad Company, with headquarters at Minneapolis.— The marriage of Ralph Hamlin to Miss Jessie Ruth Machlin took place Tuesday evening, October 6. The ceremony was performed at Grace Church, Harrisburg, Pa., at half-past eight o'clock. The warmest congratulations of Course I. and of the entire class are extended to the happy couple.

1901.

FREDERICK W. FREEMAN, *Sec.*, West Newton, Mass.

There have been but few notices received during the summer of changes in occupation or residence of the members of '01. The secretary received in June the announcement of the marriage of Mr. C. W. Cade to Miss Charlotte May Garrett.— F. K. Baxter has again taken to the gold fields, this time in South Dakota. He is at present assayer for the Hidden Fortune Gold Mining Company of Lead, So. Dak.— H. P. McDonald is assistant superintendent of the Snead & Co. Iron Works of Jersey City, N.J. He has been lately engaged in some work in designing and manufacturing of structural and ornamental iron and bronze works for buildings. — Ray Murray is with the American Bridge Company at Wissahickon, Pa.— George T. Wilson is assistant mechanical engineer for Frank B. Gilbreth, of Boston, general contractor.—A. W. Peters is engaged in the construction of a large masonry dam and power house at Glens Falls, N.Y., for the development of 32,000 horse power.— M. C. Brush has severed his connection with the Rock Island system to accept the position of assistant to the president of the Boston Suburban Electric Railway Companies. He is residing at present in Newtonville.— H. A. Putnam is in charge of the cable testing in lead encasing department of the John A. Roebling's Sons Co. of Trenton, N.J.

1902.

CHARLES W. KELLOGG, JR., 51 St. Paul Street, Brookline, Mass.

A. E. Lombard was married on Sept. 23, 1903, to Marie Pregsley, of Kansas City, Mo.— C. A. Sawyer, Jr., has left the Mining Laboratory of the Institute, and is now with Andrew D. Fuller, consulting engineer, 3 Hamilton Place, Boston.— William R. Greeley has been travelling in Europe during the past summer.— A. W. Friend is now with the Edison Electric Illuminating Company of Boston.— Arthur L. Collier is with the United Shoe Machinery Company of Boston.—Irving W. Reynolds is in the employ

of the Massachusetts Electric Company, 84 State Street, Boston.— R. W. Morrill has left the Edison Electric Illuminating Company to join the Electric Storage Battery Company.— One of the saddest events in our class history occurred on Aug. 10, 1903, in the death of Kent T. Stow in Buffalo, N.Y. Stow was very well known in the class, and liked and respected by all who knew him. He took a lively interest in class and Institute matters, and held many offices during his college career. Stow was twenty-five years old at the time of his death. He leaves one child. The following resolutions were adopted by the class, and sent to Stow's family : —

> Whereas at this time it has pleased God to take from among us our friend and fellow-classmate, Kent Tillinghast Stow ; and
>
> Whereas in his death the class of nineteen hundred and two loses one of its previous officers and best-beloved members, and one who, during his college days, ever worked for the class and the Institute,— now, therefore,
>
> *Resolved*, That the class hereby publicly expresses the respect and affection in which it held him and its deepest and most genuine sorrow for his death, and extends to the bereaved family its sincerest sympathy in this its hour of sorrow ; and be it further
>
> *Resolved*, That a copy of these resolutions be spread upon the records of the class, and that a copy of the same be sent to the parents of the deceased.

The secretary wishes to announce that the first Class Book will appear about Jan 1, 1904, and earnestly requests that all who see this page will make sure that their address, occupation, and condition (married or single), and any other items of interest, are properly entered in the class record.

1903.

CLAUDE P. NIBECKER, *Sec.*, Springfield, Mass.

The first graduate officers of the class are : president, H. S. Morse, first vice-president, H. S. Baker ; second vice-president, J. F. Ancona ; secretary and treasurer, C. P. Nibecker ; assistant secretary and treasurer, W. H. Adams.

NECROLOGY

HON. FRANK ALPINE HILL

Through the death, on September 12, of Dr. Frank A. Hill, Secretary of the State Board of Education, the Institute lost a very active and efficient member of its Corporation.

Mr. Hill was born in Biddeford, Me., in 1841, of a sterling New England ancestry which for generations had been conspicuous in town and State affairs. A graduate of Bowdoin College, he started his active life as a teacher, soon giving up that work, however, to take up the study of the law. Although prepared for admission to the bar, Mr. Hill never practised law, preferring to return to the work of teaching, and to devote himself to a profession for which by temperament and inclination he was peculiarly well fitted. His first position in Massachusetts, to which he was appointed in 1865, was as principal of the Milford Hill School. Five years later he became principal of the Chelsea High School, where he remained sixteen years. Thence he went to Cambridge to take the headship of the Cambridge English High School. After seven years there, he accepted the head-mastership of the newly opened Mechanic Arts High School in Boston. He had scarcely assumed these new duties, however, when he was appointed to the secretaryship of the State Board of Education,— a position made vacant by the death of Dr. Dickinson.

Dr. Hill became Secretary of the Board of Education in 1894. At the same time, by virtue of his office, he would have become a member of the Corporation of the Institute of Technology had he not already been chosen to membership by process of election. Therefore he was doubly a Trustee of the Institute, and admirably did he justify the repeated choice. Many men as busy as Dr. Hill would have regarded the duties in connection with the Institute as merely perfunctory; but he was far too conscientious to take such a view of his membership in the Corporation.

Moreover, his many years of experience with preparatory schools sending large numbers of young men to the Institute of Technology had given him a special interest in that college, and had fitted him in an unusual way to understand its needs and opportunities. Most fortunately, therefore, for the Institute, Mr. Hill not only was faithful in his attendance upon the meetings of the Corporation, upon the graduation exercises and other occasions requiring the presence of the Trustees, but he also gave much time and thought to the affairs of the institution, doing valuable and effective work, especially, upon the visiting committee on the departments of literature, history, and political economy, of which he was for a number of years chairman.

Of his tireless and important work as Secretary of the State Board of Education, this is not the place to speak; but only when one has some knowledge of the enormous labor of that office, and of the broad outlook upon educational affairs which it gives, can he fairly appreciate what it meant for Mr. Hill to assume the added burden of the affairs of the Institute, and what it meant for the Institute itself to have among its counsellors a man of Mr. Hill's wide and enlightening experience.

BOOK REVIEWS

ELECTRO-MAGNETS: THEIR DESIGN AND CONSTRUCTION

By A. N. Mansfield. Van Nostrand. Science Series.

The tendency to intellectual *embonpoint* which characterizes so many of the works on the electro-magnet makes this little book of Mr. Mansfield's seem positively refreshing. Although, as he says in the preface, no claim is made for originality, yet the arrangement is well done, and the information contained in the book comprehensive. Following a brief discussion of the principles of magnetism and the magnetic circuit, together with something on magnetic testing, we have a chapter devoted to the materials of construction; and then the various winding formulæ are given, together with a good treatment of the heating of the coils and the permissible current and depth of winding in any given problem. Something on tractive and alternating electro-magnets completes the work. The numerous tables are valuable and well arranged. The book should prove useful, and in the next printing we would suggest the correction of numerous typographical errors. H. E. C.